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Technical Report 882

Relationship Between Vehicle Identification Performance and the Armed Services Vocational Aptitude Battery (ASVAB)

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Otto H. Heuckeroth and Norman D. Smith
U.S. Army Research Institute

March 1990

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The development and testing of training programs for combat vehicle identification was conducted from 1980-1986 under the Target Acquisition and Analysis Training System (TAATS) work unit at Fort Hood, Texas. During that time]5 independent research projects were completed. This research evaluated the programs as well as a variety of factors related to training program performance, e.g., motion, alternate media, retention, and repeated training. The Manpower and Personnel Integration (MANPRINT) initiative motivated the exploration of the magnitude and validity of relationships between Armed Services Vocational Aptitude Battery (ASVAB) and vehicle identification performance. Comparable vehicle identification performance data from those efforts exist for 942 soldiers; ASVAB scores and vehicle identification performance data from those efforts exist for about 600 soldiers. These relationships were examined using (1) unweighted Pearson correlations; (2) correlations of performance with individual differentially weighted ASVAB scores; (3) multiple correlations involving different ASVAB scaled scores and subtests; and (4) discriminant analyses to predict high and low achieving soldiers.   (Continued) ᴺ

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19. ABSTRACT (Continued)

Researchers found

1. Correlations based on equally weighted scores for individual ASVAB scaled scores and subtests are in the high .20s and low .30s.

2. When ASVAB scores for individual scaled scores and subtests are differentially weighted, modest increase (of about .05) in the absolute value of the correlations may be obtained.

3. Multiple correlations involving more than one ASVAB scaled score or subtest are comparable to correlations obtained by the differential weighting of scores for individual ASVAB scaled scores and subtests.

4. Soldiers who will score "high" or "low" in vehicle identification performance can be identified in advanced about 75% of the time by using quadratic discriminant functions involving ASVAB scaled scores.

5. Supplementary analyses involving use of random sample halves generally confirm the validity of relationships reported.

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Otto H. Heuckeroth and Norman D. Smith
U.S. Army Research Institute

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Training and Simulation

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As part of a research task titled Target Acquisition and Analysis Training System (TAATS), the Fort Hood Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) developed a series of target recognition and identification (R&I) training programs. Both Training and Doctrine Command (TRADOC) and Forces Command (FORSCOM) recognized the need for standardized R&I training and requested that ARI develop such programs. With the support of the Combined Arms Center (CAC), Fort Leavenworth, Kansas, 15 independent research, development, and evaluation (RDE) efforts were completed in the 1980-1986 period.

With the increasing importance of the Manpower and Personnel Integration (MANPRINT) initiative, ARI has emphasized investigation of the relationship between performance measures and soldier scores on the Armed Services Vocational Aptitude Battery (ASVAB)--a battery of scaled scores and subtests used by the Army for selection and assignment of personnel. Data from various military units during those RDE efforts was useful in developing a large and reliable database of soldier vehicle identification performance. The relative ease of obtaining ASVAB data for a large proportion of these soldiers made it possible and desirable to explore the relationship between the ASVAB scores and vehicle identification performance.

A copy of this report has been provided to the proponent for vehicle identification, CAC, Fort Leavenworth, Kansas.

EDGAR M. JOHNSON
Technical Director

ACKNOWLEDGMENT

RELATIONSHIPS BETWEEN VEHICLE IDENTIFICATION PERFORMANCE AND THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB)

EXECUTIVE SUMMARY

Requirement:

Current Army emphasis on the Manpower and Personnel Integration (MANPRINT) initiative to aid in the development of Army systems stresses the importance of understanding the relationships between soldier performance and aptitude. In this spirit the purpose of this report is to explore the relationship between one criterion performance measure--vehicle identification accuracy and Armed Services Vocational Aptitude Battery (ASVAB) scores as predictor variables.

Procedure:

Data suitable for the analyses were obtained for 942 soldiers from 11 of the 15 independent research projects conducted within the scope of the Target Acquisition and Analysis Training System (TAATS) work unit at Fort Hood, Texas from 1980 to 1986.

Prior to initiating this evaluation, a database of common information was designed and constructed. For each soldier trained, ASVAB scaled (standard) scores and subtest scores were obtained. These data were used in a series of correlational and discriminant analyses to determine the relationships that exist between vehicle identification performance and soldier aptitude (ASVAB). Analyses included unweighted (Pearson) correlations, correlations based on differentially weighting scale values of each ASVAB scaled score and subtest, multiple correlations that used combinations of ASVAB scores, and discriminant analyses to predict high (upper two-thirds) versus low vehicle identification performance soldiers. Since the reliability of vehicle identification performance scores (the criterion measure) was quite high ($r = .88$), no correction for attenuation of correlations was necessary.

Findings:

Correlations based on equally weighted scores for individual ASVAB scaled scores and subtests are in the high .20s and low .30s.

When ASVAB scores for individual scaled sores and subtests are differentially weighted, modest increases (of about .05) in the absolute value of the correlations may be obtained.

Multiple correlations involving more than one ASVAB scaled score or subtest are comparable to correlations obtained by the differential weighting of scores for individual ASVAB scaled scores and subtests.

Soldiers who will score "high" or "low" in vehicle identification performance can be identified in advance about 75% of the time by using quadratic discriminant functions involving ASVAB scaled scores.

Supplementary analyses involving use of random sample halves generally confirm the validity of relationships reported.

Utilization of Findings:

The quadratic discriminant functions described in this report may be used by the Army as a tool to assist in selecting soldiers for MOS where vehicle identification ability is (or is not) important.

RELATIONSHIP BETWEEN VEHICLE IDENTIFICATION PERFORMANCE AND THE ARMED SERVICES
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Introduction

Current Army-wide and Army Research Institute (ARI) management emphasis on the Manpower and Personnel Integration (MANPRINT) initiative to aid in the development of Army systems stresses the importance of understanding the relationships between soldier performance and aptitude. In this spirit the purpose of the present report is to explore the relationship between one criterion performance measure--vehicle identification accuracy and Armed Services Vocational Aptitude Battery (ASVAB) scores as predictor variables.

Conceptually, the Target Acquisition and Analyses Training System (TAATS) has included within its domain the goal of achieving a better understanding of human performance in the entire target acquisition process--target detection, recognition, identification (R&I), and tactical analysis. From 1980 to 1986 under the TAATS umbrella, a series of Combat Vehicle Identification (CVI) programs were developed, tested and adopted by the Army. A key feature of these programs was the presentation of photopic (daylight) images of friendly and threat vehicles at simulated battlefield ranges. In order to conduct the evaluation of the various aspects of these programs, generally three views of each of five vehicles were trained in a single training period; such a grouping of vehicles constituted a training module. For each of the training evaluation efforts conducted, a single training session involved training soldiers with between two and six modules. In the training, the images were presented and the instructor would indicate key features of the vehicle that were visible at the simulated ranges. Each of the program evaluation efforts involved presenting tests with two to five images of each of the vehicles trained. For the effort described herein, criterion data from results obtained in eleven research efforts were used. Specifically, the criterion data used were the vehicle identification performance scores on a test given after completion of one training session. In each of these efforts it was possible to use as the performance (criterion) measure, the number of photopic images correctly identified for vehicles trained in three modules with two views (a front and an oblique) per vehicle. Performance scores so obtained had a possible range of 0-30. In the course of testing during these eleven research efforts, performance measures were collected for 942 soldiers. These eleven efforts were designed to assess training effectiveness under several conditions, including: (1) effects of vehicle motion during training; (2) task complexity; (3) relative effectiveness of training with different training media; and (4) the importance of retraining on acquisition and recall of vehicle identification skills. The eleven efforts involved using soldiers stationed in units throughout Continental United States (CONUS), U.S. Army in Europe (USAREUR) and U.S. Army South (SOUTHCOM).

Method

Development of the Combat Vehicle Identification Master Data Base

As noted earlier, work by the Fort Hood Field Unit over the past several years has involved several independent data collection efforts in which soldiers were trained and tested for their ability to recognize and identify (R&I) friendly and enemy combat vehicles. Under the sponsorship of the

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Combined Arms Center (CAC) at Fort Leavenworth, TAATS was engaged in the development and evaluation of these programs. Within a systems context, many of those research efforts resulted in performance data reflecting R&I knowledges. When the role of the Fort Hood Field Unit of ARI in this effort was discontinued, it appeared desirable to develop a MASTER data base which contained data elements common to the various TAATS research efforts. Generally, these elements fall into three classes: 1) Background and demographic characteristics; 2) Performance--specifically number of photopic images correctly identified; and 3) Aptitude measures (ASVAB Scaled Scores and Subtests). The process involved in development of this data base as a Statistical Analysis Software (SAS) data set required examination of the individual data bases for fifteen coordinated research and development efforts in the TAATS program. Based on that review, only those performance data common to eleven of those research efforts were included. For example, in some efforts the posttraining test involved exposure to two views of each vehicle while in other studies three and five were used. To increase the comparability of performance data, only the posttraining test responses to images of vehicles in the two commonly presented views (front, left or right oblique) were used to define the identification performance (criterion) measure. [1]

Following development of the performance and background and demographic characteristics of the MASTER data base in the spring of 1986, a request was made to obtain ASVAB Composites and Subtest scores.[2] ASVAB Composite scores were standardized (scaled) scores while Subtest scores received were in raw score form. In order to provide a measure of standardization for Subtest scores based on different numbers of items, all Subtest scores were converted to percentages prior to any analyses. Tables 1 and 2 list the ASVAB Subtests found in different forms of this test and the particular Subtests used in defining each Composite measure.

It is important to emphasize that the task required of the soldier, i.e., identification of a vehicle, is relatively complex. Identification as defined throughout the TAATS research is naming or giving the number of the vehicle--for example, T-62, Bradley, or Leopard. Embodied in this response is the implicit knowledge that the vehicle is a "Friend" or "Threat" and that it falls into one of several classes of vehicles--for example, tank, armored personnel carrier or self-propelled gun. A substantial part of the task was cognitive in combination with simple rote learning and perception.

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[1] A complete description of this data base, including variables used, is available from the ARI Fort Hood Field Unit on request.
[2] Composite scores are computed by combining two or more Subtest scores in various combinations. For purposes of this analysis, the Armed Forces Qualification Test (AFQT) is considered a composite. The ASVAB data used in all analyses was received from the Manpower Data Center in Monterey, California, with backup support from the Manpower Personnel Research Laboratory of ARI.

Table 1

Subtests Used in ASVAB Test Forms 5-7 and ASVAB Test Forms 8-14

ASVAB Test Forms 5-7	ASVAB Test Forms 8-14
Armed Forces Qualification Test (AFQT) Subtest	
Word Knowledge (WK)	Word Knowledge (WK)
Arithmetic Reasoning (AR)	Arithmetic Reasoning (AR)
Space Perception (SP)	Paragraph Comprehension (PC)
	Numerical Operations (NO)
Other Subtests	
Numerical Operations (NO)	
General Information (GI)	
Electronics Information (EI)	General Science (GS)
Mathematical Knowledge (MK)	Electronics Information (EI)
Mechanical Comprehension (MC)	Mathematical Knowledge (MK)
Automotive Information (AI)	Mechanical Comprehension (MC)
Shop Information (SI)	Auto/Shop Information (AS)[a]
Attention-to-Detail (AD)	Coding Speed (CS)[b]
General Science (GS)	Verbal (VE)
Classification-Inventory Scales	
Mechanical (CM)[c]	
Attentiveness (CA)[c]	
Electronics (CE)[c]	
Outdoors (CC)[c]	

Note: Information obtained from annotated computer printouts provided by Francis Grafton, HQ ARI, Data Base Management Project Leader, Manpower and Personnel Research Laboratory (MPRL).
[a]Combination of previous subtests: AI and SI. [b]Highly speeded test designed to replace Attention-to-Detail. [c]Does not appear in ASVAB test form 5.

Table 2

Aptitude Area Composites Used in ASVAB Test Forms 5-7 and ASVAB Test Forms 8-14

Aptitude Area Composite	Subtest Used in Computing Composites	
	ASVAB Test Forms 5-7	ASVAB Test Forms 8-14
Combat (CO)	AR+SI+SP+AD+CC	AR+AS+MC+CS
Field Artillery (FA)	AR+GI+MK+EI+CA	AR+MK+MC+CS
Electronics (EL)	AR+EI+SI+MC+CE	AR+EI+MK+GS
Operators/Foods (OF)	GI+AI+CA	NO+VE[a]+MC+AS
Surveillance/Communications (SC)	AR+WK+MC+SP	NO+CS+VE+AS
Motor Maintenance (MM)	MK+EI+SI+AI+CM	NO+EI+MC+AS
General Maintenance (GM)	AR+GS+MC+AI	MK+EI+GS+AS
Clerical (CL)	AR+WK+AD+CA	NO+CS+VE
Skilled Technical (ST)	AR+MK+GSB	VE+MK+MC+GS
General Technical (GT)	AR+WK	VE+AR

Note 1: Raw subtest scores from ASVAB Test Forms 5-7 are used in computation of Composites.
Note 2: Composites for ASVAB test form 5 are as defined for ASVAB test forms 6 and 7 except that Subtests CA,CC, CE and CM were not used.
Note 3: Standard subtest scores from ASVAB Test Forms 8-14 are used in computation.
[a]Verbal (VE) is a standard score conversion of the sum of raw scores for word knowledge (WK) and paragraph comprehension (PC).

Characteristics of Soldiers Included in the Master Database

While missing data precludes use of the entire sample of soldiers in all analyses, it is nevertheless relevant to provide generally descriptive data along several dimensions. These data speak to the relative heterogeneity of soldier sample studied. Characteristics of the sample described include: 1) Military Occupational Specialty (MOS) (See Table 3); 2) Rank (See Table 4); 3) Racial and Ethnic Background (See Table 5); 4) Education (See Table 6); 5) Age (See Table 7); 6) Service Time (See Table 8); and 7) Time in MOS (See Table 9). In addition it is interesting to note that 22.8 % (n = 211) of soldiers included in this data base used glasses on the job;[3] 11.1% (n = 100) used them for reading only.[4] Finally, the vast majority of soldier sample were males (96.5%, n = 828).[5]

It is important to note that it was generally beyond the scope of this effort to explore performance and aptitude relationships for particular soldier characteristics categories.

Data Analysis

This effort had two primary objectives: 1) to explore the relationship between vehicle identification performance and ASVAB Scaled Scores or Subtest scores and 2) to provide analyses which document the validity of the relationships obtained. In addressing these objectives, four analytic techniques were used: 1) Correlations of individual ASVAB Scaled Scores and Subtests with soldier vehicle identification performance, 2) multiple correlations between soldier vehicle identification performance and ASVAB Scaled Scores or Subtests as predictor variables, 3) correlations of differentially weighted scores of ASVAB predictor variables with vehicle identification performance, and 4) discriminant analyses.

It is important to note that in this effort analyses were generally performed using data from ASVAB Test Forms 5-7, 8-14 and 5-14 for random halves of soldiers for which data were available, and the entire set of data available. Separate analyses for different ASVAB test forms were motivated by the general understanding that there are rather major differences in test structure for ASVAB versions beginning with test form 8 compared with earlier ASVAB versions. Analyses for random halves were completed primarily to address the validity of findings reported. The procedure used in forming random halves involved sorting soldiers by Social Security Number and, in the case of the discriminant analyses, also involved sorting soldier identification performance scores. In each case, data from the first, third, fifth, etc., soldiers constituted the ODD half; the remaining cases the EVEN half.

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[3] Data concerning use of glasses on job is missing for 16 soldiers.
[4] Data concerning use of glasses for reading is missing for 41 soldiers.
[5] Data on soldiers' sex missing for 84 cases.

For correlations involving differentially weighted ASVAB predictor variables (Scaled Scores and Subtests), all available data were used; separate analyses for different ASVAB test forms were not performed. In order to assign weights for categories of each ASVAB predictor variable, frequency tabulations were first performed for each predictor value. From these tabulations categories of values were formed so that each category would be represented by approximately 15 to 20 observations for ODD and EVEN random samples[6]. In turn, weights which maximized the correlation between each ASVAB predictor and vehicle identification performance were obtained for the complete sample as well as ODD and EVEN halves.[7] Further, weights were assigned to categories of each predictor variable so that 15 to 20 observations existed for each category of the total sample. In this latter case, weights for a larger number of categories were used as additional fitting constants. In order to address the validity of these correlations, the weights obtained for ODD and EVEN halves were used to compute the correlations for the complete sample.

Low correlations are sometimes found because the criterion itself is unreliable. This is usually a result of poorly defined measurements, use of overly subjective judgements, inadequately trained data collectors, uncalibrated equipment, or some combination of these factors. In order to assure that findings reported here were not attenuated by low reliability of criterion variable--identification performance--results of two consecutive post training tests with no intervening training were correlated yielding a retest reliability of .88.[8] Applying the correction for attenuation to the criterion described by Guilford produced negligible changes in correlations involving ASVAB Scaled Scores and Subtests with identification performance.[9] Consequently, correlations reported have not been corrected for the very slight unreliability they manifest.

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[6]In the context of multiple correlational analyses, Herzberg (1969) indicated that to obtain stable correlations--across other samples--there should be about 15 to 20 observations per weight estimated; i.e., with N as sample size and K the number of weights estimated, the N/K ratio should approach 20. See Herzberg, P.A. The parameters of cross-validation. Psychometrika Monograph Supplement. 1969, No. 16.

[7]Weights were estimated by a computer algorithm utilizing "pattern search." The function minimized was $1 - | r |$. See C.F. Wood "Recent Developments in Direct Search Techniques". Westinghouse Research Laboratories, Research Report 62-159-522R1, 31 July 1962.

[8]Myers, J.L. Fundamentals of Experimental Design, Allyn & Bacon, Boston 1967, pp. 294-299.

[9]Guilford, J.P. Psychometric Methods, McGraw-Hill, Inc., New York, 1954, pp. 400-402.

Table 3

Military Occupational Speciality (MOS) of Soldiers Included in the
CVI Master Data Base

MOS	Frequency	Percent	MOS Description
05B	8	.9	Signal MOS[a]
05C	16	1.7	Signal MOS[a]
05G	3	0.3	Signal Security Specialist
11B	118	12.6	Infantryman
11C	17	1.8	Indirect Fire Infantryman
11D	1	0.1	MOS description unknown
11H	37	3.9	Heavy Armor Weapons Infantryman
11M	56	6.0	Fighting Vehicle Infantryman
12A	2	0.2	MOS description unknown
12B	9	1.0	Combat Engineer
12C	3	0.3	Bridge Crew Member
12D	1	0.1	MOS description unknown
12E	1	0.1	Atomic Demolition Munitions Specialist
12Z	1	0.1	Combat Engineering Senior Sergeant
13B	22	2.3	Cannon Crew Member
13E	4	0.4	Cannon Fire Direction Specialist
13F	29	3.1	Fire Support Specialist
13R	5	0.5	Field Artillary Firefinder Radar Operator
16B	2	0.2	Air Defense Artillery Hercules Missile Crewmember
16P	5	0.5	Air Defense Artillery CHAPARRAL Crewmember
16R	24	2.6	VULCAN Crewmember
16S	15	1.6	Man Portable Air Defense System Crewmember
17C	1	0.1	Field Artillery Target Acquisition Specialist
17K	4	0.4	Ground Surveillance Radar Crewman
19D	103	11.0	Cavalry Scout
19E	154	16.4	M48 M60 Armor Crewman
19F	2	0.2	MOS description unknown
19J	1	0.1	MOS description unknown
19K	94	10.0	M-1 Armor Crewman
24G	1	0.1	HAWK Information Coordination Central Mechanic
24M	1	0.1	VULCAN System Mechanic
24N	1	0.1	CHAPARRAL System Mechanic
31E	1	0.1	Field Radio Repairer
31M	7	0.7	Multichannel Communications Systems Operator
31N	1	0.1	Tactical Circuit Controller
31V	4	0.4	Unit Level Communications Maintainer

Table 3 (cont´d)

MOS	Frequency	Percent	MOS Description
33S	2	0.2	Electronic Warfare/Intercep System Maintainer
35K	1	0.1	Avionic Mechanic
36C	5	0.5	Wire Systems Installer
36K	12	1.3	Signal MOS[a]
45E	1	0.1	M1 Abrams Tank Turret Mechanic
62E	1	0.1	Heavy Construction Equipment Operator
62J	1	0.1	General Construction Equipment Operator
63B	15	1.6	Light Wheel Vehicle Mechanic
63C	1	0.2	Mechanical Maintenance[a]
63D	1	0.1	Self-propelled Field Artillery System Mechanic
63F	3	0.3	Mechanical Maintenance[a]
63N	2	0.2	M60A1/A3 Tank System Mechanic
63S	1	0.1	Heavy Wheel Vehicle Mechanic
63T	3	0.3	Bradley Fighting Vehicle System Mechanic
63Y	4	0.4	Track Vehicle Mechanic
64C	8	0.9	Motor Transport Operator
67N	5	0.5	Utility Helicopter Repairer
67V	3	0.3	Observation/Scout Helicopter Repairer
67Y	2	0.2	AH-1 Attack Helicopter Repairer
67Z	1	0.1	Aircraft Maintenance Senior Sergeant
68B	1	0.1	Aircraft Powerplant Repairer
68M	1	0.1	Aircraft Weapon Systems Repairer
71L	9	1.0	Administrative Specialist
71M	1	0.1	Chaplain Assistant
72E	7	0.7	Tactical Telecommunications Center Operator
75B	6	0.6	Personnel Administration Specialist
75Z	3	0.3	Personnel Sergeant
76C	3	0.3	Equipment Records and Parts Specialist
76P	1	0.1	Materiel Control and Accounting Specialist
76V	3	0.3	Materiel Storage and Handling Specialist
76W	4	0.4	Petroleum and Supply Specialist
76Y	29	3.1	Unit Supply Specialist
79D	4	0.4	Reenlistment NCO
81E	1	0.1	Illustrator
84B	1	0.1	Still Photographic Specialist
91A	4	0.4	Medical Specialist
91B	14	1.5	Medical NCO
91C	1	0.1	Practical Nurse
93F	1	0.1	Field Artillery Meteorological Crewmember
94B	5	0.5	Food Service Specialist
95B	2	0.2	Military Police

Table 3 (cont'd)

MOS	Frequency	Percent	MOS Description
96B	2	0.2	Intelligence Analyst
96C	1	0.1	Interrogator
98C	6	0.6	Electronic Warfare/Signal Intelligence Analyst
TOTAL			
	936		

Note: MOS missing for six soldiers

a Specific MOS description not known--no longer listed in AR 611-201.

Table 4

Rank of the Soldier Sample in the CVI Master Data Base

Pay Grade	Frequency (Percent)
E1	28 (3.0)
E2	88 (9.3)
E3	206 (21.9)
E4	292 (31.0)
E5	167 (17.7)
E6	111 (11.8)
E7	40 (4.2)
E8	3 (0.3)
E9	7 (0.7)
Total	942

Table 5

Racial or Ethnic Background of the Soldier Sample in the CVI Master Data Base for the Army During 1978-1984

Race or Ethnicity	Sample Frequency (Percent)	Army Composition (Percent)
Black	286 (30.8)	31
Hispanic	119 (12.8)	5
White	490 (52.8)	60
Other	33 (3.6)	4
Total	928	

Note: Racial or ethnic data missing for 14 soldiers.

Table 6

Educational Background of Soldier Sample in the CVI Master Data Base

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Educational Level	Frequency (Percent)
8 Years	3 (0.4)
1 Yr High School	22 (2.8)
2 Yr High School	43 (5.5)
3-4 Yr High School, No Diploma	69 (8.9)
High School Graduate, Diploma, Attendance Certificate or GED	587 (75.5)
1 Yr College	18 (2.3)
2 Yr College	19 (2.4)
3-4 Yr College, No Degree	9 (1.2)
College Graduate (Bachelors)	6 (0.8)
Masters Degree	1 (0.1)
Total	777

Note: Educational background data missing for 165 soldiers.

Table 7.

Age of the Soldier Sample in the CVI Master Data Base

Age	Frequency (Percent)	
17	4	(0.4)
18	30	(3.2)
19	93	(10.0)
20	111	(12.0)
21	114	(12.3)
22	94	(10.1)
23	90	(9.7)
24	63	(6.8)
25	35	(3.8)
26	32	(3.5)
27	27	(2.9)
28	33	(3.6)
29	31	(3.3)
30	25	(2.7)
31	20	(2.2)
32	16	(1.7)
33	15	(1.6)
34	17	(1.8)
35	15	(1.6)
36	12	(1.3)
37 & above	50	(5.4)
Total	927	

Note: Age missing for 15 soldiers.

Table 8.

Length of Time in Service of Soldier Sample in the CVI Master Data Base

Time in Service (months)	Frequency	(Percent)
4-24	323	(35.0)
25-48	281	(30.4)
49-72	111	(12.0)
73-96	70	(7.6)
97-144	81	(8.8)
145-193	40	(4.3)
$\geq$ 194	18	(1.9)
Total	924	

Note: Length of service time is missing for 18 soldiers.

Table 9.

Length of Time in Military Occupational Speciality (MOS) of the Soldiers in the CVI Master Data Base

Time in MOS (months)	Frequency	(Percent)
1-24	351	(49.0)
25-48	224	(31.3)
49-72	80	(11.2)
73-96	36	(5.0)
$\geq$ 97	25	(3.5)
Total	716	

Note: Length of time in MOS is missing for 226 soldiers.

Results

Individual ASVAB Scaled Score and Subtest Relationships to Identification Performance

Table 10 presents the correlations between each ASVAB Scaled Score and identification performance together with their statistical significance, sample size (N) and for ODD and EVEN halves a Z statistic to assess the significance of differences between correlations.[10] Including the correlations for ODD and EVEN halves as well as those based on the total sample, all but three are significantly different from zero; all of the correlations based on the total sample are statistically significant. The range of correlations obtained using test forms 5-7 is .246 (for the CL Composite) to .354 (for the SC Composite); for test forms 8-14 the range is .119 (for the CL Composite) to .289 (for the ST Composite). For all test forms the range is .212 (for the CL Composite) to .336 (for the GM Composite). This means that between 1.4% and 12.5% of the variability between ASVAB Scaled Scores and identification performance is in common.

In a similar manner Table 11 presents the same information as Table 10 but for ASVAB Subtests. For several Subtests—NO, CS, AD, CM, CA, CE, and CC—correlations with identification performance are not significantly different from zero. The range of correlations obtained using test forms 5-7 which are significant range from .156 (for SP Subtest) to .351 (for GI Subtest); for test forms 8-14, the range for those which are significant is .179 (for EI Subtest) to .295 (for GS Subtest). For all test forms, the range of significant correlations is .156 (for SP Subtest) to .351 (for GI Subtest). Again this means that between 2.4% and 12.3% of the variability between ASVAB Subtests and identification performance is in common.

As noted in the METHOD section, separate analyses for test forms 5-7 and 8-14 were performed because of the understanding that there were rather large substantive changes beginning with test form 8 compared to earlier forms. Table 12 shows the correlations for ASVAB Scaled Scores and the seven Subtests common to most test forms with identification performance. While in every case the correlations using test forms 5-7 scores are higher in absolute value than comparable correlations involving test forms 8-14, only in one case (SC Composite) did the Z test for testing significance of differences among correlations prove statistically significant ($p < .05$). With 18 comparisons, one statistically significant difference could occur by chance about 5% of the time.

It was also noted in the METHOD section that in order to assess the validity of the obtained correlations, the data were divided into random halves with comparison of correlations for each half serving as a measure of the validity of the relationship reported. In Tables 10 and 11 there are a total of 67 different comparisons. In these 67, four proved to have significantly different Z values at the .05 level or better. Since 4/67 x 100 is approximately 6% and there was no a priori expectation that the obtained correlations for random halves would differ significantly, it seems reasonable

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[10]McNemar, Q. Psychological Statistics, John Wiley and Sons, New York, 1966, pp. 139-140.

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Table 10

Correlational Matrix of Identification Performance With ASVAB Scaled Scores for Independent Sample Halves and Total Sample for Soldiers Who Took an ASVAB Test Form 5-7 or 8-14

ASVAB Scaled Scores		TEST FORM 5-7 ODD HALF	TEST FORM 5-7 EVEN HALF	TEST FORM 5-7 TOTAL	TEST FORM 8-14 ODD HALF	TEST FORM 8-14 EVEN HALF	TEST FORM 8-14 TOTAL	TEST FORM 5-14 ODD HALF	TEST FORM 5-14 EVEN HALF	TEST FORM 5-14 TOTAL
AFQT[a]	r[b]	.290	.370	.330	.217	.297	254	.325	.289	.307
	P	.0002	.0001	.0001	.0112	.0004	.0001	.0001	.0001	.0001
	N	155	154	309	136	136	272	291	290	581
	Z[c]	.70			.69			.47		
CO	r	.290	.369	.330	.249	.218	.233	.292	.311	.302
	P	.0003	.0001	.0001	.0033	.0108	.0001	.0001	.0001	.0001
	N	155	155	310	137	136	273	292	291	583
	Z	.78			.27			.25		
FA	r	.290	.363	.323	.171	.290	.227	.278	.311	.296
	P	.0002	.0001	.0001	.0461	.0006	.0002	.0001	.0001	.0001
	N	156	155	311	136	136	272	292	291	583
	Z	.71			1.03			.44		
MM	r	.310	.323	.315	.160	.282	.217	.318	.256	.287
	P	.0001	.0001	.0001	.0608	.0008	.0003	.0001	.0001	.0001
	N	157	156	313	138	138	276	295	294	589
	Z	.12			1.06			.81		
GM	r	.329	.390	.357	.395	.174	.282	.309	.363	.336
	P	.0001	.0001	.0001	.0001	.0425	.0001	.0001	.0001	.0001
	N	156	155	311	138	137	275	291	293	586
	Z	.61			1.99*			.73		
CL	r	.252	.238	.246	.045	.205	.119	.221	.202	.212
	P	.0016	.0028	.0001	.6002	.0162	.0484	.0001	.0006	.0001
	N	155	155	310	137	137	274	292	292	584
	Z	.14			1.33			.26		
GT	r	.229	.351	.285	.304	.182	.235	.283	.241	.261
	P	.0044	.0001	.0001	.0001	.0234	.0001	.0001	.0001	.0001
	N	154	153	307	156	155	311	309	309	618
	Z	1.16			1.14			.56		
EL	r	.288	.406	.342	.278	.286	.278	.325	.327	.326
	P	.0003	.0001	.0001	.0011	.0007	.0001	.0001	.0001	.0001
	N	156	155	311	136	136	272	292	291	583
	Z	1.17			.07			.02		
SC	r	.375	.334	.354	.215	.193	.202	.316	.272	.305
	P	.0001	.0001	.0001	.0136	.0236	.0008	.0001	.0001	.0001
	N	155	155	310	138	137	275	293	292	585
	Z	.42			.16			.44		
ST	r	.350	.336	.317	.419	.173	.289	.257	.349	.316
	P	.0001	.0001	.0001	.0001	.0438	.0001	.0001	.0001	.0001
	N	156	155	311	138	137	275	293	293	586
	Z	.35			2.21*			.90		
OF	r	.228	.366	.290	.163	.308	.235	.292	.272	.282
	P	.0042	.0001	.0001	.0555	.0002	.0001	.0001	.0001	.0001
	N	157	156	313	138	138	276	295	294	589
	Z	1.32			1.26			.27		

[a] All values on same line as Scale Score names are correlations.

[b] P values address the significance of individual correlations and were provided as part of the Statistical Analyses Software (SAS) PROC CORR output.

[c] Z values were computed by the formula: $|Z_{r_1} - Z_{r_2}| / \sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}$. See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. 1962.

pp. 139-140. For two tailed tests, $|Z| \geq 1.96$ is significant at $p < .05$. Tabled Zs address the significance of difference between correlations obtained using independent halves of available data. Z values which are significant are noted by *.

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Table 11

Correlational Matrix of Identification Performance With ASVAB Subtests (Percent Correct) for Independent Sample Halves and Total Sample for Soldiers Who Took an ASVAB Test Form 5-7 or 8-14

ASVAB SUBTEST	TEST FORM 5-7 ODD HALF	TEST FORM 5-7 EVEN HALF	TEST FORM 5-7 TOTAL	TEST FORM 8-14 ODD HALF	TEST FORM 8-14 EVEN HALF	TEST FORM 8-14 TOTAL	TEST FORM 5-14 ODD HALF	TEST FORM 5-14 EVEN HALF	TEST FORM 5-14 TOTAL
CS[a] r[b]	.250	.444	.339	.297	.291	.295	.347	.320	.333
p	.0015	.0001	.0001	.0004	.0005	.0001	.0001	.0001	.0001
N[c]	158	157	315	138	138	276	295	296	591
Z		1.94			.05			.35	
AR r	.292	.186	.237	.260	.165	.203	.242	.222	.235
p	.0002	.0199	.0001	.0022	.0921	.0008	.0001	.0001	.0001
N	156	156	312	137	136	273	293	292	585
Z		1.00			.98			.25	
WK r	.310	.216	.264	.210	.273	.242	.283	.262	.271
p	.0001	.0064	.0001	.0133	.0012	.0001	.0001	.0001	.0001
N	158	158	316	138	138	276	296	296	592
Z		.89			.54			.28	
NO r	.112	-.020	.046	.028	.006	.015	.078	.065	.073
p	.1590	.7996	.4112	.7426	.9413	.8042	.1788	.2624	.0746
N	159	159	318	138	138	276	297	297	594
Z		1.17			.18			.16	
MK r	.331	.185	.255	.300	.138	.217	.333	.145	.241
p	.0001	.0203	.0001	.0003	.1093	.0003	.0001	.0126	.0001
N	157	157	314	138	137	275	295	294	589
Z		1.40			1.39			2.41*	
MC r	.304	.387	.342	.062	.346	.208	.295	.303	.299
p	.0001	.0001	.0001	.4679	.0001	.0005	.0001	.0001	.0001
N	157	156	313	138	138	276	295	294	589
Z		.82			2.45*			.10	
EI r	.164	.307	.233	.197	.171	.179	.258	.231	.245
p	.0394	.0001	.0001	.0206	.0451	.0028	.0001	.0084	.0001
N	159	158	317	138	138	276	297	296	593
Z		1.34			.23			1.70	
PC r	ASVAB versions 5-7 did not contain a PC Subtest			.096	.27	.183	.096	.271	.183
p				.2675	.001?	.0326	.2675	.0015	.0026
N				135	135	270	135	135	270
Z					1.44			1.48	
CS r	ASVAB versions 5-7 did not contain a CS Subtest			-.025	.082	.042	-.025	.082	.042
p				.7746	.2506	.6412	.7746	.2506	.6412
N				138	137	275	138	138	276
Z					1.01			1.01	
AS r	ASVAB versions 5-7 did not contain an AS Subtest			.266	.186	.225	.266	.186	.225
p				.0893	.0009	.0005	.0893	.0009	.0005
N				137	137	275	138	137	275
Z					1.15			1.15	

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Table 11 (cont'd)

ASVAB SUBTEST	TEST FORM 5-7 ODD HALF	TEST FORM 5-7 EVEN HALF	TEST FORM 5-7 TOTAL	TEST FORM 8-14 ODD HALF	TEST FORM 8-14 EVEN HALF	TEST FORM 8-14 TOTAL	TEST FORM 5-14 ODD HALF	TEST FORM 5-14 EVEN HALF	TEST FORM 5-14 TOTAL
VE	ASVAB versions 5-7 did not contain a VE Subtest			.312	.167	.235	.312	.167	.235
P				.0645	.0004	.0001	.0645	.0004	.0001
N				138	137	278	138	137	275
Z					1.20			1.20	
CI	.380	.326	.351	ASVAB versions 8-14 did not contain a CI Subtest			.380	.326	.351
P	.0002	.0001	.0001				.0002	.0001	.0001
N	154	154	308				154	154	308
Z		1.29						1.29	
AD	-.092	-.109	-.101	ASVAB versions 8-14 did not contain an AD Subtest			-.092	-.109	-.101
P	.8065	.3268	.3727				.8065	.3268	.3727
N	157	156	313				157	156	313
Z		.52						.52	
SP	.137	.179	.156	ASVAB versions 8-14 did not contain an SP Subtest			.137	.179	.156
P	.0345	.0269	.0025				.0345	.0269	.0025
N	156	155	311				156	155	311
Z		.06						.06	
SI	.316	.351	.332	ASVAB versions 8-14 did not contain an SI Subtest			.316	.351	.332
P	.0005	.0002	.0001				.0005	.0002	.0001
N	154	153	307				154	153	307
Z		.15						.15	
AI	.278	.254	.268	ASVAB versions 8-14 did not contain an AI Subtest			.278	.254	.268
P	.0001	.0328	.0001				.0001	.0328	.0328
N	154	153	307				154	153	307
Z		1.21						1.21	
CM	-.030	.128	.049	ASVAB versions 8-14 did not contain a CM Subtest			-.030	.128	.049
P	.7011	.1068	.3849				.7011	.1068	.3849
N	161	160	321				161	160	321
Z		1.41						1.41	
CA	-.073	-.012	-.043	ASVAB versions 8-14 did not contain a CA Subtest			-.073	-.012	-.043
P	.3545	.8768	.4400				.3545	.8768	.4400
N	161	160	321				161	160	321
Z		.54						.54	
CE	-.058	.030	-.011	ASVAB versions 8-14 did not contain a CE Subtest			-.058	.030	-.011
P	.4662	.7033	.8501				.4662	.7033	.8501
N	161	160	321				161	160	321
Z		.78						.78	
CC	.033	.168	.100	ASVAB versions 8-14 did not contain a CC Subtest			.033	.168	.100
P	.6758	.0342	.0735				.6758	.0342	.0735
N	161	160	321				161	160	321
Z		1.20						1.20	

[a] All values on same line as Subtest names are correlations.

[b] P values address the significance of individual correlations and were provided as part of the Statistical Analyses Software (SAS) PROC CORR output.

[c] Z values are computed by the formula: $| z_{r_1} - z_{r_2} | / \sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}$. See McNemar, Q. *Psychological Statistics*, John Wiley and Sons, Inc.

1962, pp. 139-160. For two tailed tests, $| Z | \geq 1.96$ is significant at $p < .05$. Tabled Zs address the significance of difference between correlations obtained using independent halves of available data. Z values which are significant are noted by *.

Table 12

Comparison of ASVAB Scaled Scores and Subtests Correlations With Identification
Performance for Soldiers Who Took An ASVAB Test Form 5-7 or 8-14

| | Scaled Scores | | | Subtests (Common to all forms) | |
	Test Form 5-7 Total	Test Form 8-14 Total		Test Form 5-7 Total	Test Form 8-14 Total
AFQT[a]	.330	.254	GS	.339	.295
$\underline{P}$[b]	.0001	.0001	$\underline{P}$	.0001	.0001
$\underline{N}$	309	272	$\underline{N}$	315	276
$\underline{Z}$[c]		1.00	$\underline{Z}$		.58
CO	.330	.233	AR	.237	.203
$\underline{P}$	.0001	.0001	$\underline{P}$	.0001	.0008
$\underline{N}$	310	273	$\underline{N}$	312	273
$\underline{Z}$		1.27	$\underline{Z}$		.42
FA	.323	.227	WK	.264	.242
$\underline{P}$	.0001	.0002	$\underline{P}$	.0001	.0001
$\underline{N}$	311	272	$\underline{N}$	316	276
$\underline{Z}$		1.25	$\underline{Z}$		.28
MM	.315	.217	NO	.046	.015
$\underline{P}$	.0001	.0003	$\underline{P}$	.4112	.8042
$\underline{N}$	313	276	$\underline{N}$	318	276
$\underline{Z}$		1.27	$\underline{Z}$		.37
GM	.357	.282	MK	.255	.217
$\underline{P}$	.0001	.0001	$\underline{P}$	.0001	.0003
$\underline{N}$	311	275	$\underline{N}$	314	275
$\underline{Z}$		.97	$\underline{Z}$		.48
CL	.246	.119	MC	.342	.208
$\underline{P}$	.0001	.0484	$\underline{P}$	.0001	.0005
$\underline{N}$	310	274	$\underline{N}$	313	276
$\underline{Z}$		1.58	$\underline{Z}$		1.74
GT	.285	.235	EI	.233	.179
$\underline{P}$	.0001	.0001	$\underline{P}$	.0001	.0028
$\underline{N}$	307	311	$\underline{N}$	317	276
$\underline{Z}$		.67	$\underline{Z}$		.69
EL	.342	.278			
$\underline{P}$	.0001	.0001			
$\underline{N}$	311	272			
$\underline{Z}$		.85			
SC	.354	.202			
$\underline{P}$	.0001	.0008			
$\underline{N}$	310	275			
$\underline{Z}$		1.98*			
ST	.317	.289			
$\underline{P}$	.0001	.0001			
$\underline{N}$	311	275			
$\underline{Z}$		.37			
OF	.290	.235			
$\underline{P}$	.0001	.0001			
$\underline{N}$	313	276			
$\underline{Z}$		.72			

[a]All values on same line as Scale Score and Subtest names are correlations.
[b]$\underline{P}$ values address the significance of individual correlations and were provided as part of the Statistical Analyses Software (SAS) PROC CORR output.
[c]$\underline{Z}$ values were computed by the formula: $\left| z_{r_1} - z_{r_2} \right| \Big/ \sqrt{\dfrac{1}{N_1 - 3} + \dfrac{1}{N_2 - 3}}$.

See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. 1962,
pp. 139-140. For two tailed tests, $\left| Z \right| \geq 1.96$ is significant at $\underline{p} < .05$. Tabled
Zs address the significance of difference between correlations obtained using
independent halves of available data.
* $\underline{p} < .05$.

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to believe that these four correlations which differ significantly are due to chance. This interpretation in turn leads to an inference that the obtained relationships are indeed valid.

Multiple Correlation Relationships Involving ASVAB Scaled Scores or Subtests as Predictors and Identification Performance as Criterion

Procedure for Analyses Involving ASVAB Scaled Scores [Composites and Armed Forces Qualification Test (AFQT)]. As with correlations involving individual ASVAB Scaled Scores, multiple correlations were obtained generally for random halves of the data. Such analyses were designed to address the matter of validity of obtained relationships—when sample sizes were sufficiently large to satisfy Herzberg's criterion for obtaining stable multiple correlation relationships across different samples.[11]

Multiple correlation relationships involving the ten area Aptitude Composites and AFQT (ASVAB Scaled Scores) with identification performance are summarized in Table 13. Since with 11 predictor variables there are 2047 possible predictor sets for predicting the criterion, it is reasonable to consider only selected sets for both describing and validating relationships which exist. As with individual predictor and criterion correlations, separate analyses were performed with test form 5-7 data, 8-14 and 5-14 for the total sample. In each of these cases PROC STEPWISE from the SAS package was used to select the best set from the 11 predictor variables. The predictor set selected was the one which satisfied Mallow's criterion—Cp statistic—as described in the SAS manual.[12] Results of these analyses are presented in row 1, columns 4, 7, and 10 of Table 13. As noted in each case the best predictor set involved a single Aptitude Area (AA) Composite. In order to address the question of the validity of the obtained relationships, the total sample in each case was randomly divided into halves and the correlations involving that single AA composite with the criterion were computed using PROC RSQUARE from SAS. Results of those analyses are shown, as indicated, in row 1 of Table 13.

While statistically the best subset of predictor variables involved only one AA Composite, it was of some interest to examine changes in absolute multiple correlation magnitude that might result with use of larger predictor subsets.

Rather than explore all subsets, it was decided to examine the "best" subset of six predictors for each case. A subset size of six was selected as the sample size in each random half would be sufficiently large according to Herzberg (1969) to obtain reasonably stable multiple correlational relationships. "Best," again was defined as that subset which satisfied

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[11]With N as the sample size and K the number of predictor variables, Herzberg (1969) indicated that to obtain stable multiple correlations—across other samples—the N/K ratio should approach 20, i.e., there should be approximately 20 observations per weight estimated. See Herzberg, P.A. The Parameters of Cross-Validation. Psychometrika Monograph Supplement, 1969, No. 16.

[12]Mallow's criterion for selection of a "best" multiple correlation relationship involves selecting the model with the predictor variables which first lead the Cp statistic to approach p (the number of weights estimated, excluding the intercept). See SAS User's Guide: Statistics, Version 5, pp. 765-766 for more detailed discussion.

Mallow's criterion when the total sample was used. Using only ASVAB scaled scores from Test Forms 5-7, the best subset of six involved the EL, GT, CL, OF, CO and MM Aptitude Area scaled scores with an R of .400 (see row 2, column 4, Table 13). The multiple correlations involving this subset of predictors were computed to produce all other entries in row 2. Using only ASVAB Scaled Scores from test forms 8-14, the best subset of six involved the ST, CL, SC, CO, OF and AFQT scaled scores with an R of .341 (see row 3, column 7, Table 13). As before, the multiple correlations involving this subset of predictors was computed to produce other entries in row 3. Finally row 4 shows the multiple correlations which results when all 11 Scaled Scores are used--for random halves and total sample. Multiple correlations involving all 11 Scaled Scores were not computed for test forms 5-7 or 8-14 individually since the N/K ratios (per Herzberg, 1969) were not sufficiently large to obtain stable correlational values.

Based on review of Table 13 it appears that the multiple correlation approach does not produce any marked improvement in the demonstrated relationships between individual ASVAB Scaled Scores and the criterion variable--although in all cases when Herzberg's (1969) guidance is followed there is no evidence to conclude that the relationships obtained are not valid.

Procedure for Analyses Involving ASVAB Subtests. Multiple correlational analyses involving ASVAB Subtests in many ways parallels analyses for ASVAB Scaled Scores discussed above--separate analyses for data involving test forms 5-7, 8-14 and 5-14 using the total samples and for each random half (See Table 14). In each case analyses presented are consistent with Herzberg's (1969) guidance that approximately 20 observations per predictor be available. Generally, results shown in the first four rows of Table 14 were, in part, based on use of PROC STEPWISE of SAS package. The specific procedure used for each of those rows will be described momentarily. In reviewing Table 14 it is important to understand that in ASVAB test forms 5-7 there are 16 Subtest scores; for test forms 8-14 there are eleven. For test forms 5-14 there are seven common Subtests. Results presented in rows 1-3 and 5 of Table 14 consider only these seven common Subtests as predictors--for comparability across analyses as well as to reflect sensitivity to Herzberg's (1969) guidance noted above.

For results presented in row 1, PROC STEPWISE of SAS was used to identify the best subset of predictors using the total sample available for those soldiers who had been given one of ASVAB test forms 5-7. As in discussion of the comparable set of analyses involving ASVAB Scaled Scores, Mallow's criterion[13] was used to select the "best" subset (See row 1, column 4, Table 14). Other results presented in row 1 address the issues of validity and generality of findings using other data.

For results presented in row 2 (Table 14) the "best" subtest of predictors using the total sample available for soldiers given one of ASVAB test forms 8-14 involved a single Subtest (See column 7). As before, other results presented in row 2 address the issues of validity and generality of findings.

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[13]Op. Cit. 12.

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Table 13

Selected Multiple Correlations of Identification Performance With ASVAB Scaled Scores for Independent Sample Halves and Total Sample for Soldiers Who Took An ASVAB Test Form 5-7 or 8-14

Test Forms 5-7

Predictor Sets	Odd Half	Even Half	Total
	(SC)	(SC)	(SC From 11 Scaled Scores)[a]
R	.431	.286	.361
N[b]	118	118	236
Z		1.27	
	(EL, GT, CL, OF, CO, MM)	(EL, GT, CL, OF, CO, MM)	(EL, GT, CL, OF, CO, MM)[c]
R	.466	.365	.400
N	118	118	236
Z		.92	
	(ST, CL, SC, CO, OF, AFQT)	(ST, CL, SC, CO, OF, AFQT)	(ST, CL, SC, CO, OF, AFQT)
R	.497	.369	.393
N	118	118	236
Z		1.19	

Test Forms 8-14

Predictor Sets	Odd Half	Even Half	Total
	(ST)	(ST)	(ST From 11 Scaled Scores)[a]
R	.310	.279	.295
N[b]	124	123	247
Z		.27	
	(EL, GT, CL, OF, CO, MM)	(EL, GT, CL, OF, CO, MM)	(EL, GT, CL, OF, CO, MM)
R	.314	.323	.312
N	124	123	247
Z		.08	
	(ST, CL, SC, CO, OF, AFQT)	(ST, CL, SC, CO, OF, AFQT)	(ST, CL, SC, CO, OF, AFQT)[c]
R	.353	.342	.341
N	124	123	247
Z		.10	

Test Forms 5-14

Predictor Sets	Odd Half	Even Half	Total
	(GM)	(GM)	(GM From 11 Scaled Scores)[a]
R	.293	.413	.361
N[b]	242	241	483
Z		1.50	
	(EL, GT, CL, OF, CO, MM)	(EL, GT, CL, OF, CO, MM)	(EL, GT, CL, OF, CO, MM)
R	.343	.402	.360
N	242	241	483
Z		.75	
	(ST, CL, SC, CO, OF, AFQT)	(ST, CL, SC, CO, OF, AFQT)	(ST, CL, SC, CO, OF, AFQT)
R	.336	.415	.361
N	242	241	483
Z		1.02	
	(All 11 Scaled Scores)	(All 11 Scaled Scores)	(All 11 Scaled Scores)
R	.374	.437	.378
N	242	241	483
Z		.81	

[a] This multiple predictor variable set was obtained using PROC STEPWISE of the Statistical Analysis Software (SAS) with MODEL option MINR. As recommended in the SAS manual for this procedure, the model selected involved that set of predictor variables when the C_p statistic first approached the number of weights estimated—excluding the intercept. Correlations involving this predictor variable set were also obtained for ODD and EVEN halves using PROC RSQUARE for Test Forms 5-7 and 8-14 to provide added support for the validity of the obtained relationships (See Table 10). For relationships reported here, all ASVAB Scaled Scores and identification performance had to be available. In Table 10, only identification performance and the specific ASVAB Scaled Scores had to be available.

[b] Z values were computed by the formula: $\dfrac{|z_{r_1} - z_{r_2}|}{\sqrt{\dfrac{1}{N_1 - 3} + \dfrac{1}{N_2 - 3}}}$. See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. 1962, pp.139-140. For two-tailed tests, $|z| \geq 1.96$ is significant at $p < .05$. Tabled Zs address the significance of difference between correlations obtained using independent halves of available data.

[c] With N as the sample size and K as the number of predictor variables, Herzberg (1969) indicated that to obtain stable multiple correlations—across other samples—the N/K ratio should approach 20, i.e., there should be approximately 20 observations per weight estimated. Since ODD and EVEN halves contained approximately 120 observations each, the multiple correlations involving the best six ASVAB Scaled Scores for these test forms were also computed using PROC RSQUARE of SAS for the other Test Forms and all Test Forms to provide added support for the validity of the obtained relationships. See Herzberg, P. A. The parameters of cross-validation. Psychometrika Monograph Supplement, 1969. No. 16.

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Table 14

Selected Multiple Correlations of Identification Performance With ASVAB Subtests (Percent Correct) for Independent Sample Halves and Total Sample for Soldiers Who Took an ASVAB Test Form 5-7 or 8-14

Predictor Sets	Test Forms 5-7			Test Forms 8-14			Test Forms 5-14		
	Odd Half	Even Half	Total	Odd Half	Even Half	Total	Odd Half	Even Half	Total
Predictor Sets	GS, MC from Common 7 Subtests	GS, MC from Common 7 Subtests	GS, MC from Common 7 Subtests[a]	GS, MC from Common 7 Subtests	GS, MC from Common 7 Subtests	GS, MC from Common 7 Subtests[a]	GS, MC from Common 7 Subtests	GS, MC from Common 7 Subtests	GS, MC from Common 7 Subtests
R	.339	.432	.379	.323	.335	.304	.338	.363	.350
N	156	155	311	136	136	272	292	291	583
Z[b]	.96			.11			.35		
Predictor Sets	GS from Common 7 Subtests	GS from Common 7 Subtests	GS from Common 7 Subtests[a]	GS from Common 7 Subtests	GS from Common 7 Subtests	GS from Common 7 Subtests[a]	GS from Common 7 Subtests	GS from Common 7 Subtests	GS from Common 7 Subtests
R	.304	.393	.344	.313	.303	.302	.330	.343	.338
N	156	155	311	136	136	272	292	291	583
Z	.90			.09			.18		
Predictor Sets	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests[a]	NO, GS, MK, MC from Common 7 Subtests	NO, GS, MK, MC from Common 7 Subtests[a]
R	.352	.438	.388	.326	.372	.313	.375	.366	.357
N	156	155	311	136	136	272	292	291	583
Z	.87			.43			.14		
Predictor Sets	GI, CC, MC, CA from all 16 Subtests	GI, CC, MC, CA from all 16 Subtests	GI, CC, MC, CA from all 16 Subtests	GS from all 11 Subtests	GS from all 11 Subtests	GS from all 11 Subtests[a]			
R	.415	.452	.420	.389	.220	.300			
N	154	154	308	135	134	269			
Z	.39			1.51					
Predictor Sets	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests	Common 7 Subtests
R	.356	.442	.392	.342	.417	.317	.376	.376	.364
N	156	155	311	136	136	272	292	291	583
Z	.90			.72			0.00		

[a] This multiple predictor variable set was obtained for these Test Forms using PROC STEPWISE of the Statistical Analysis Software (SAS) with MODEL option MINR. As recommended in the SAS manual for this procedure, the model selected involved that set of predictor variables when the C_p statistic first approached the number of weights estimated—excluding the intercept. As appropriate, the multiple correlation involving this predictor variable set were also obtained for ODD/EVEN halves using PROC RSQUARE for Test Form 5-7 and 8-14 to provide added support for the validity of the obtained relationships.

[b] Z values were computed by the formula: $|Z| = \dfrac{|z_{r_1} - z_{r_2}|}{\sqrt{\dfrac{1}{N_1 - 3} + \dfrac{1}{N_2 - 3}}}$. See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. 1962, pp. 139-140. For two tailed tests, $|Z| \geq 1.96$ is significant at $p < .05$. Tabled Zs address the significance of difference between correlations obtained using independent halves of available data.

Results presented in row 3, column 10, Table 14) represent the "best" subset of the common 7 Subtest predictors which involved all available data (Test Forms 5-14). Again, as before, other results cited in row 3 address issues of validity and generality of findings with different data.

Results presented in row 4 (table 14) indicate the "best" subset of Subtest predictors using all available Subtests for the particular ASVAB test forms indicated. Again, results for random halves address the issue of validity.

Finally results presented in row 5 (Table 14) present the multiple correlations involving all common 7 Subtest predictors. These results were obtained by using PROC RSQUARE of SAS.

Major Findings. For correlations involving ASVAB Scaled Scores (Composites and AFQT) the best predictor set is defined by a single Composite (GM) with a magnitude of about .36 (Table 13). A multiple correlation of comparable magnitude (.35) is obtained for a Subtest predictor set of 4 (NO, GS, MK,MC) out of seven Common Subtests when data from all test forms (5-14) are used (Table 14).

It is particularly encouraging to note that none of the $\underline{Z}$ tests which compare multiple correlations for random halves are significant. As with findings involving individual ASVAB Scaled Scores and Subtests, this finding is consistent with an inference concerning the validity of the reported relationships.

Differential Weighting Correlations

In attempting to determine the relationship among predictive and criterion variables, it seems reasonable to ask whether weighting different values of the predictor variables by values other than one might improve the apparent relationship. As repeatedly emphasized in this report the concern has been on both documenting the relationships as well as providing results which point to the validity of those relationships. The METHOD section has described the procedure used and the rationale. For each ASVAB Scaled Score or Subtest, Tables 15 and 16 show: 1) the different correlations computed; 2) the $\underline{F}$ test which assesses the statistical significance of the correlations, 3) the sample size ($\underline{N}$) on which the correlation is based; 4) the number of weights ($\underline{K}$) estimated in computing the correlations; and 5) where appropriate, $\underline{Z}$ tests to assess the significance of differences among correlations. In order, by numbered column, Tables 15 and 16 show: 1) the ASVAB Scaled Score or Subtest; 2) columns 2 through 6 show correlations when the total sample of available data is used; and 3) columns 7 and 8 are based on ODD and EVEN halves of the data, respectively. Column 2 shows the standard Pearson correlations where each predictor variable score is weighted by 1. Columns 3 and 4 show modified Pearson correlations where weights for different categories of predictor variable scores have been estimated so as to make the reported correlations a maximum; correlations reported in column 4 generally use almost twice as many categories as for the correlations reported in column 3. Correlations reported in columns 7 and 8 were computed using the same categories for the predictor variables as used for correlations reported in column 3 but for random halves of the data. Category weights estimated for correlations reported in columns 7

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Table 15

Correlations Between Weighted and Unweighted ASVAB Scaled Score Predictors and Vehicle Identification Performance

ASVAB Scaled Scores (1)		Correlations for Total Sample		Using Wts. Estimated in Column (7) and (8)		Correlations for Half Samples (ODD Half and EVEN Half) Using Wts. Estimated from:	
	Unweighted[a] (2)	Weighted[a] (3)	Weighted[a] (4)	ODD Half[b] (5)	EVEN Half[b] (6)	ODD Half[b] (7)	EVEN Half[b] (8)
AFQT r_d	.307[c]	.326[c]	.354[c]	.301	.302	.355	.352
F^d	60.25**	4.19**	2.54**	57.68**	58.11**	2.47**	2.41**
N^e	581	581	581	581	581	291	290
K (No. Wgts. Est.)[f]	1	16	31	1	1	16	16
z^g					.02		.04
CO r	.302[c]	.348[c]	.383[c]	.318	.328	.333	.419
F	58.31**	4.87**	3.06**	65.36**	70.04**	2.14**	3.65**
N	583	583	583	583	583	292	291
K (No. Wgts. Est.)	1	16	31	1	1	16	16
z					.06		1.21
FA r	.296[c]	.353[c]	.379[c]	.316	.300	.428	.373
F	55.79**	5.04**	2.98**	64.45**	57.46**	3.85**	2.77**
N	583	583	583	583	583	292	291
K (No. Wgts. Est.)	1	16	31	1	1	16	16
z					.32		.78
MM r	.287[c]	.341[c]	.381[c]	.314	.314	.390	.354
F	52.69**	4.70**	3.05**	64.21**	64.21**	3.12**	2.48**
N	589	589	589	589	589	295	294
K (No. Wgts. Est.)	1	16	31	1	1	16	16
z					0		.50
GM r	.336[c]	.368[c]	.395[c]	.340	.353	.346	.430
F	74.32**	5.57**	3.30**	76.33**	83.13**	2.35**	3.91**
N	586	586	586	586	586	293	293
K (No. Wgts. Est.)	1	16	31	1	1	16	16
z					.26		1.19

Table 15 (cont'd)

ASVAB Scaled Scores (1)		Correlations for Total Sample			Using Wts. Estimated in Column (7) & (8):		Correlations for Half Samples (ODD Half and EVEN Half) Using Wts. Estimated from:	
		Unweighted (2)	Weighted (3)	Weighted (4)	ODD Half (5)	EVEN Half (6)	ODD Half (7)	EVEN Half (8)
CL	r	$.212^c$	$.258^c$	$.303^c$	.208	.228	.258	.347
	F	27.39**	2.53**	1.80**	26.32**	31.91**	1.23	2.35**
	N	584	584	584	584	584	292	292
K (No. Wgts. Est.)		1	16	31	1	1	16	16
	Z					.34		1.18
GT	r	$.261^c$	$.283^c$	$.317^c$	.257	.250	.310	.315
	F	45.03**	3.27**	2.11**	43.56**	41.07**	1.94*	2.01*
	N	618	618	618	618	618	309	309
K (No. Wgts. Est.)		1	16	31	1	1	16	16
	Z					.12		.07
EL	r	$.326^c$	$.354^c$	$.387^c$	.324	.326	.390	.379
	F	69.09**	5.07**	3.13**	68.14**	69.09**	3.08**	2.87**
	N	583	583	583	583	583	292	291
K (No. Wgts. Est.)		1	16	31	1	1	16	16
	Z					.04		.16
SC	r	$.305^c$	$.321^c$	$.353^c$	.305	.289	.371	.321
	F	59.80**	4.08**	2.54**	59.80**	53.13**	2.75**	1.97*
	N	585	585	585	585	585	293	292
K (No. Wgts. Est.)		1	16	31	1	1	16	16
	Z					..29		.69
ST	r	$.316^c$	$.359^c$	$.397^c$	.332	.342	.363	.402
	F	64.79**	5.26**	3.34**	72.34**	77.35**	2.62**	3.33**
	N	586	586	586	586	586	293	293
K (No. Wgts. Est.)		1	16	31	1	1	16	16
	Z					.19		.55
OF	r	$.282^c$	$.356^h$	$.394^h$	.345	.336	.432	.313
	F	50.71**	5.19**	3.30**	79.31**	74.70**	3.99**	1.88*
	N	589	589	589	589	589	295	294
K (No. Wgts. Est.)		1	16	31	1	1	16	16
	Z					.18		1.67

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Table 15 (cont'd)

Note: Predictor variable categories and weights estimated for each category will be provided on request.

[a] The significance of difference among weighted and unweighted correlations was estimated with the $\underline{F}$ statistic. For these evaluations

$$\underline{F} = [(R^2_1 - R^2_2) / (K_1 - K_2)] / [(1-R^2_1) / (N - K_1 - 1)],$$ with $\underline{F}$ evaluated on $K_1 - K_2$ and $N-K_1-1$ degrees of freedom.

[b] Only the slope coefficient used in computing the usual Pearson correlation was estimated in this computation. Predictor variable scores were transformed with weights estimated during calculation of correlations reported in the last two columns of this table.

[c] Superscripts for these correlations which are the same indicate no significant differences--$\underline{p}$>.05--; where superscripts are different, $\underline{p}$ <.05. See McNemar, Q., Psychological Statistics, John Wiley and Sons, Inc. (3rd Edition) 1962, p. 284.

[d] The significance of each individual correlation was estimated with the $\underline{F}$ statistic. For these evaluations

$$\underline{F} = [R^2 / (1 - R^2)][(N-K-1) / K],$$ with $\underline{F}$ evaluated on K and $N-K-1$ degrees of freedom.

See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. (3rd Edition), 1962, p. 283.

[e] N values tabled are the number of pairs of observations used in computing the tabled correlations.

[f] Number of weights estimated includes weights for each predictor variable category of weighted correlations plus the slope coefficient used in computing the Pearson correlation.

[g] The significance of difference between independent correlations based on ODD and EVEN sample halves was estimated with $\underline{Z}$ statistic. For these evaluations

$$\underline{Z} = |z_{r_1} - z_{r_2}| \Big/ \sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}$$

For two-tailed tests, $|\underline{Z}| \geq 1.96$ is significant at $\underline{p} \leq$ .05; when $|\underline{Z}| \geq$ 2.58, $\underline{p} \leq$ .01. See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. (3rd Edition) 1962, pp 139-140.

[h] See Note c above.

$*\underline{p}$ <.05. $**$ $\underline{p}$ <.01   All tests are two-tailed.

and 8 for ODD and EVEN sample halves, respectively, were used to compute correlations for the total sample reported in columns 5 and 6. The correlations reported in column 2 are also found in Tables 10 and 11. They have been repeated here to facilitate comparisons with the differentially weighted correlations.

Inspection of Table 15 indicates that the Scaled Score correlations obtained (weighted and unweighted) are generally statistically significant (p <.05). Except for the NO, CS, AD, CM, CA and CE Subtests, the same conclusion is reached from review of Subtest correlations in Table 16. In almost every case using estimated weights to selected categories of ASVAB predictors does lead to increases in the absolute value of the obtained correlations. Generally use of more weights leads to increases in the absolute value of resulting correlations.

For each of the 31 ASVAB predictors (Scaled Scores and Subtest Scores), a total of 93 correlations were subjected to evaluation for test of significance differences--three correlations per predictor. As noted above, one of these correlations was the simple unweighted (Pearson) correlation; the remaining two were Pearson-type correlations obtained for weighted aptitude values and performance. Only for the OF Composite Scaled Score did differential weighting lead to a statistically larger (p<.05) correlational value compared to the unweighted correlation. Differential weighting led to significantly larger correlations for the GS, AS, GI and CC Subtests. Of the 93 comparisons, ten were statistically significant.

In order to address the validity of correlations obtained with differential weighting (columns 3 and 4, Tables 15 and 16), correlations (with weighting) were obtained for ODD and EVEN halves of randomly sorted data (columns 7 and 8, Tables 15 and 16) and then the weights (for predictor variable categories) estimated during the computational procedure were used to compute Pearson-type correlations for the entire set of available data (columns 5 and 6, Tables 15 and 16). Tables 15 and 16 show the results of Z tests used to assess the significance of differences in correlations for each ASVAB scale. For the ASVAB Scaled Scores no significant differences in correlations for ODD and EVEN halves occurred; for the ASVAB Subtests seven of the 40 comparisons reported were statistically significant (p<.05).

Discriminant Analyses

As research with the CVI Training Systems progressed, it became increasingly apparent that the acquisition of R&I skills is a difficult task and retention is low. Given these circumstances and the importance of R&I skills on the modern battlefield, it seemed relevant in earlier research (Smith et al. 1987a, Smith et al 1987b) to ask about the importance of individual soldier capability differences. Large standard deviations of performance indicated a large amount of individual performance variability. In the cited research this observation prompted a closer look at the performance of individual soldiers who had been exposed to repeated training. Examination of scatterplots of identification performance following the first training session and subsequent sessions seemed to indicate that soldiers who performed relatively poorly after the first session tended to show smaller performance increases with subsequent training. These initial impressions led to more definitive analyses in which soldier performance following the first training session served as a basis for categorizing them as "low" or "high" achievers.

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Table 16

Correlations Between Weighted and Unweighted ASVAB Subtest Predictors (Percent Correct) and Vehicle Identification Performance

ASVAB Subtest (1)		Correlations for Total Sample		Using Wts. Estimated in Column (7) & (8):		Correlations for Half Samples (ODD Half and EVEN Half) Using Wts. Estimated from:	
	Unweighted[a] (2)	Weighted[a] (3)	Weighted[a] (4)	ODD Half[b] (5)	EVEN Half[b] (6)	ODD Half[b] (7)	EVEN Half[b] (8)
GS r	.333[c]	.383[h]	.413[i]	.367	.367	.416	.381
F[d]	73.46**	7.07**	5.31**	91.68**	91.68**	4.20**	3.40**
N[e]	591	591	591	591	591	296	295
K (No. Wgts. Est.)[f]	1	14	22	1	1	14	14
z[g]					0.0		.51
AR r	.229[c]	.261[c]	.260[c]	.216	.227	.278	.346
F	32.27**	3.48**	1.77*	28.53**	31.67**	1.95*	3.16**
N	585	585	585	585	585	293	292
K (No. Wgts. Est.)	1	12	23	1	1	12	12
z					.19		.91
WK r	.271[c]	.290[c]	.306[c]	.258	.256	.325	.331
F	46.76**	4.08**	2.44**	42.07**	41.38**	2.56**	2.67**
N	592	592	592	592	592	296	296
K (No. Wgts. Est.)	1	13	24	1	1	13	13
z					.03		.08
NO r	.073[c]	.122[c]	.195[c]	.037	.077	.207	.222
F	3.17	.67	.86	.81	3.53	.97	1.13
N	594	594	594	594	594	297	297
K (No. Wgts. Est.)	1	13	26	1	1	13	13
z					.69		.19
MK r	.241[c]	.269[c]	.289[c]	.249	.230	.373	.224
F	36.20**	3.20**	2.05**	38.80**	32.79**	3.23**	1.05
N	589	589	589	589	589	295	294
K (No. Wgts. Est.)	1	14	25	1	1	14	14
z					.36		1.98*

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Table 16 (cont'd)

ASVAB Subtest (1)	Correlations for Total Sample			Using Wts. Estimated in Column (7) & (8):		Correlations for Half Samples (ODD Half and EVEN Half) Using Wts. Estimated from:	
	Unweighted (2)	Weighted (3)	Weighted (4)	ODD Half (5)	EVEN Half (6)	ODD Half (7)	EVEN Half (8)
MC r	.299^c	.340^c	.361^c	.317	.318	.351	.372
F	57.63**	5.36**	3.52**	65.58**	66.04**	2.81**	3.20**
N	589	589	589	589	589	295	294
K (No. Wgts. Est.)	1	14	24	1	1	14	14
Z					.02		.29
EI r	.245^c	.291^c	.323^c	.271	.259	.326	.311
F	37.74**	4.47**	3.02**	46.84**	42.50**	2.81**	2.53**
N	593	593	593	593	593	297	296
K (No. Wgts. Est.)	1	12	22	1	1	12	12
Z					.22		.20
PC r	.183^c	.215^c	.233^c	.165	.196	.206	.309
F	9.29**	1.81*	1.49	7.50**	10.71**	.80	1.92
N	270	270	270	270	270	135	135
K (No. Wgts. Est.)	1	7	10	1	1	7	7
Z					.37		.90
CS r	.042^c	.178^c	.219^c	-.095	.159	-.164	.298
F	.48	1.09	.87	2.50	7.11**	.45	1.57
N	276	276	276	276	276	138	138
K (No. Wgts. Est.)	1	8	15	1	1	8	8
Z					2.98**		3.88**
AS r	.225^c	.300^c	.360^c	.270	.272	.332	.324
F	14.61**	3.79**	2.58*	21.55**	21.89**	2.30*	2.18*
N	276	276	276	276	276	138	138
K (No. Wgts. Est.)	1	7	15	1	1	7	7
Z					.03		.07
VE r	.235^c	.275^c	.290^c	.271	.258	.378	.191
F	15.96**	2.72**	1.59	21.64**	19.47**	2.69**	.61
N	275	275	275	275	275	138	137
K (No. Wgts. Est.)	1	8	15	1	1	8	8
Z					.16		1.68

Table 16 (cont'd)

| ASVAB Subtest (1) | Correlations for Total Sample | | | | | Correlations for Half Samples (ODD Half and EVEN Half) Using Wts. Estimated from: | |
	Unweighted (2)	Weighted (3)	Weighted (4)	Using Wts. Estimated in Column (7) & (8): ODD Half (5)	EVEN Half (6)	ODD Half (7)	EVEN Half (8)
GI r	.351^c	.400^c	.408^c	.387	.383	.474	.368
F	43.00**	7.12**	4.91**	53.90**	52.60**	5.25**	2.84**
N	308	308	308	308	308	154	154
K (No. Wgts. Est.)	1	8	12	1	1	8	8
Z					.06		1.12
AD r	-.101^c	-.145^c	-.162^c	-.135	-.107	-.215	-.123
F	3.21	1.10	.67	5.77**	3.60	1.21	.38
N	313	313	313	313	313	157	156
K (No. Wgts. Est.)	1	6	12	1	1	6	6
Z					.36		.83
SP r	.156^c	.197^c	.226^c	.157	.151	.277	.235
F	7.71**	1.75	1.23	7.81**	7.21**	1.76	1.23
N	311	311	311	311	311	156	155
K (No. Wgts. Est.)	1	7	13	1	1	7	7
Z					.07		.39
SI r	.332^c	.353^c	.373^c	.341	.331	.373	.361
F	37.78**	5.30**	3.14**	40.13**	37.53**	2.93**	2.70**
N	307	307	307	307	307	154	153
K (No. Wgts. Est.)	1	8	15	1	1	8	8
Z					.14		.12
AI r	.268^c	.314^c	.335^c	.298	.289	.324	.349
F	23.60**	4.67**	2.64**	29.72**	27.80**	2.45*	2.87**
N	307	307	307	307	307	154	153
K (No. Wgts. Est.)	1	7	14	1	1	7	7
Z					.11		.25

Table 16 (cont'd)

ASVAB Subtest (1)	Correlations for Total Sample					Correlations for Half Samples (ODD Half and EVEN Half) Using Wts. Estimated from:	
	Unweighted (2)	Weighted (3)	Weighted (4)	Using Wts. Estimated in Column (7) & (8): ODD Half (5)	EVEN Half (6)	ODD Half (7)	EVEN Half (8)
CM r	$.049^c$	$.121^c$	$.173^c$	$-.085$	$.087$	$.154$	$.178$
F	.77	.58	.67	2.32	2.43	.46	.62
N	321	321	321	321	321	161	160
K (No. Wgts. Est.)	1	8	14	1	1	8	8
Z				2.17*		.21	
CA r	$-.043^c$	$-.104^c$	$-.124^c$	$-.074$	$.086$	$-.124$	$.150$
F	.59	.43	.40	1.76	2.38	.30	.43
N	321	321	321	321	321	161	160
K (No. Wgts. Est.)	1	8	12	1	1	8	8
Z				2.02*		2.43*	
CE r	$-.011^c$	$-.040^c$	$-.158^c$	$-.015$	$.014$	$-.114$	$.117$
F	.04	.07	.60	.07	.06	.29	.30
N	321	321	321	321	321	161	160
K (No. Wgts. Est.)	1	7	13	1	1	7	7
Z				.37		2.05*	
CC r	$.100^c$	$.238^h$	$.295^h$	$.224$	$.226$	$.242$	$.262$
F	3.22	2.68*	2.25**	16.85**	17.17**	1.36	1.60
N	321	321	321	321	321	161	160
K (No. Wgts. Est.)	1	7	13	1	1	7	7
Z				.03		.19	

Note: See footnotes on Table 15.

[a-h]See specific notes for Table 15. [1]See specific note c, h for Table 15
*$\underline{p}$ <.05. **$\underline{p}$ <.01. All tests are two-tailed.

Using several categorization criteria, the performance curves of these achievement groups with repeated training were plotted. While different criteria did lead to absolute differences in performance curves, inspection of those curves for most criteria generally indicated that "low" achievers take about three to four training sessions to attain a performance level attained by "high" achievers following one such session. With this background, our research effort here asked the question whether "low" and "high" achievers could be differentiated with ASVAB Scaled Scores or Subtests.

As in previous analyses reported above, the intent in these analyses was not only to compute the mathematical correlations of ASVAB scores of the sample with CVI performance, but also to provide evidence for the validity of the reported relationships. Again, as before, separate analyses were performed for ASVAB data collected with test forms 5-7, 8-14 and 5-14. In each case, these data were sorted first by social security number and then by identification performance score. For these analyses, "low" achievers were defined as soldiers scoring in the lower third of all soldiers for whom both ASVAB and performance data were available. It is generally understood that in the research community a "high" category is viewed as the upper portion of a distribution. The term "high" in this effort was used to define the top two thirds simply as a way of providing a contrasting label (to "low") to indicate that the analyses are concerned with dichotomous groups. In each case a random half of soldiers falling in the "low" achiever and "high" achiever group were combined to form constrained random sample halves. With each set of test forms, one of these halves was used as a "calibration" sample--to develop the discriminant model--once with the ASVAB Scaled Scores and again for ASVAB Subtests. These discriminant models were then used to classify the other random half. Finally the best discriminant model for the entire sample was developed for each case.[14] Tables 17, 18 and 19 summarize the classification of soldiers for each analysis, the "HIT" rate and the F test to address the validity of the discriminant model developed for one random half (calibration sample) in being able to categorize the test data from the other random half. A HIT is defined as the case where the discriminant model assigns a soldier to the same category to which his identification performance led him to be classified. First to be noted from these tables is the fact that the discriminant models developed on the "calibration" sample were about equally valid for classifying the test half of the data. While the models were valid, their accuracy in correct classification (HITS) ranged from 61% to 80% when random halves of the data are considered. Considering only the results for the entire sample, the "HIT" rate ranged from 68% to 77%.

One way in which discriminant analyses could prove useful to the Army is in the area of MOS assignment. Once an individual has completed the ASVAB prior to service entry, his classification as a "Low" achiever in vehicle identification could serve as a basis for counseling the individual into an MOS where R&I is not especially important. Alternately, the results of the discriminant analysis might be used by the Army as one criterion which determines a soldier's eligibility to be assigned an MOS where vehicle identification ability is especially important. Further, with the many unit

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[14]Analyses were performed using PROC DISCRIM in SAS with the PRIORS variable defined as Low = 1/3, High = 2/3 and with a test to determine whether a linear or quadratic discriminant function was most useful.

decide on who should or should not receive (repeated) R&I training. In order
to provide the Army with this capability, the weights used in the ASVAB
discriminant model must be provided (See Appendix B). In examining the
results summarized in Tables 17-19, it appears that the discriminant models
involving ASVAB Scaled Scores for test forms 5-7 and 8-14 provide the highest
expected accuracy for classifying soldiers--in each case a quadratic
discriminant function proved best. For soldiers who took one of test forms
5-7, the expected classification accuracy ("HIT" rate) is 75%; for those who
took one of forms 8-14, the "HIT" rate is 77%. These functions and a brief
description of their use is found in Appendix B.

Table 17

Discriminant Analyses Performed Using ASVAB Scaled Scores and Subtests (Test Forms 5-7) for a Calibration (ODD HALF), Test (EVEN HALF) and Total Sample

ODD HALF (CALIBRATION DATA)

ASVAB Scaled Scores (Test Forms 5-7) Classified by a Linear Discriminant Function as

APRIORI ACHIEVE GROUPS	HIGH	LOW	TOTAL
HIGH	69	9	78
	88.46	11.54	100.00
LOW	25	15	40
	62.50	37.50	100.00
TOTAL	94	24	118
	79.66	20.34	100.00

$X^2 = 11.00$, $p<.001$ "Hits" = 71%

ASVAB Common Subtests (Test Forms 5-7) Classified by a Quadratic Discriminant Function as

APRIORI ACHIEVE GROUPS	HIGH	LOW	TOTAL
HIGH	88	16	104
	84.62	15.38	100.00
LOW	16	36	52
	30.77	69.23	100.00
TOTAL	104	52	156
	66.67	33.33	100.00

$X^2 = 45.23$, $p<.001$ "Hits" = 79%

EVEN HALF (TEST DATA)

ASVAB Scaled Scores (Test Forms 5-7) Classified by a Linear Discriminant Function as

APRIORI ACHIEVE GROUPS	HIGH	LOW	TOTAL
HIGH	66	13	79
	83.54	16.46	100.00
LOW	26	13	39
	66.67	33.33	100.00
TOTAL	92	26	118
	77.97	22.03	100.00

$X^2 = 4.33$, $p<.05$ "Hits" = 67%
$F_{(1,1)} = 2.54$, $p>.05$

ASVAB Common Subtests (Test Forms 5-7) Classified by a Quadratic Discriminant Function as

APRIORI ACHIEVE GROUPS	HIGH	LOW	TOTAL
HIGH	77	26	103
	74.76	25.24	100.00
LOW	36	16	52
	69.23	30.77	100.00
TOTAL	113	42	155
	72.90	27.10	100.00

$X^2 = .53$, $p<.05$ "Hits" = 60%
$F_{(1,1)} = 85.34$, $p>.05$

TOTAL SAMPLE

ASVAB Scaled Scores (Test Forms 5-7) Classified by a Quadratic Discriminant Function as

APRIORI ACHIEVE GROUPS	HIGH	LOW	TOTAL
HIGH	132	25	157
	84.08	15.92	100.00
LOW	33	46	79
	41.77	58.23	100.00
TOTAL	165	71	236
	69.92	30.08	100.00

"Hits" = 75%

ASVAB Common Subtests (Test Forms 5-7) Classified by a Quadratic Discriminant Function as

APRIORI ACHIEVE GROUPS	HIGH	LOW	TOTAL
HIGH	168	39	207
	81.16	18.84	100.00
LOW	52	52	104
	50.00	50.00	100.00
TOTAL	220	91	311
	70.74	29.26	100.00

"Hits" = 70%

Note 1: ACHIEVE groups were defined based on rank order of soldiers identification performance score. Those falling in the lower third were defined as LOW; those in the upper two thirds were defined as HIGH. PRIORS parameter in the Statistical Analysis Software (SAS) PROC DISCRIM was defined to reflect this definition.

Note 2: Tabled $F_{(1,1)}$s are the ratio of the X^2(ODD)/X^2(EVEN). Generally the ratio of two independent chi-squares divided by their respective degrees of freedom (n_1, n_2) is defined as an F. See McNemar, Q. Psychological Statistics. John Wiley and Sons, Inc, 1962, pp. 250-251.

Note 3: It is noted that for some of the tabled findings, results based on a linear discriminant function analysis are provided. For these results, statistical analysis performed by SAS determined that the within covariance matrices were homogeneous. In such cases no significant improvement in categorizing soldiers results from using individual within covariance matrices—as required for computing a quadratic discriminant function. Linear discriminant functions were computed using a pooled within covariance matrix.

Table 18

Discriminant Analyses Performed Using ASVAB Scaled Scores and Subtests (Test Forms 8-14) for a Calibration (ODD HALF), Test (EVEN HALF) and Total Sample

ODD HALF (CALIBRATION DATA)

ASVAB Scaled Scores (Test Forms 8-14) Classified by a Linear Discriminant Function as

		HIGH	LOW	TOTAL
APRIORI ACHIEVE GROUPS	HIGH	74	9	83
		89.16	10.84	100.00
	LOW	30	11	41
		73.17	26.83	100.00
	TOTAL	104	20	124
		83.87	16.13	100.00

$X^2 = 5.18$, $p<.03$ "Hits" = 69%

ASVAB Common Subtests (Test Forms 8-14) Classified by a Quadratic Discriminant Function as

		HIGH	LOW	TOTAL
APRIORI ACHIEVE GROUPS	HIGH	79	11	90
		87.78	12.22	100.00
	LOW	26	20	46
		56.52	43.48	100.00
	TOTAL	105	31	136
		77.2%	22.79	100.00

$X^2 = 16.90$, $p<.001$ "Hits" = 73%

EVEN HALF (TEST DATA)

ASVAB Scaled Scores (Test Forms 8-14) Classified by a Linear Discriminant Function (Test Data) as

		HIGH	LOW	TOTAL
APRIORI ACHIEVE GROUPS	HIGH	75	7	82
		91.46	8.54	100.00
	LOW	33	8	41
		80.49	19.51	100.00
	TOTAL	108	15	123
		87.80	12.20	100.00

$X^2 = 3.07$, $p<.10$ "Hits" = 67%
$F(1,1) = 1.68$, $p>.05$

ASVAB Common Subtests (Test Forms 8-14) Classified by a Quadratic Discriminant Function (Test Data) as

		HIGH	LOW	TOTAL
APRIORI ACHIEVE GROUPS	HIGH	70	21	91
		76.72	23.08	100.00
	LOW	27	18	45
		60.00	40.00	100.00
	TOTAL	97	39	136
		71.3%	28.68	100.00

$X^2 = 4.22$, $p<.05$ "Hits" = 65%
$F(1,1) = 4.01$, $p>.05$

TOTAL SAMPLE

ASVAB Scaled Scores (Test Forms 8-14) Classified by a Quadratic Discriminant Function as

		HIGH	LOW	TOTAL
APRIORI ACHIEVE GROUPS	HIGH	145	20	165
		87.88	12.12	100.00
	LOW	36	46	82
		43.90	56.10	100.00
	TOTAL	181	66	247
		73.28	26.72	100.00

"Hits" = 77%

ASVAB Common Subtests (Test Forms 8-14) Classified by a Quadratic Discriminant Function as

		HIGH	LOW	TOTAL
APRIORI ACHIEVE GROUPS	HIGH	164	17	181
		90.61	9.39	100.00
	LOW	56	35	91
		61.54	38.46	100.00
	TOTAL	220	52	272
		80.88	19.12	100.00

"Hits" = 73%

Note 1: ACHIEVE groups were defined based on rank order of soldiers Identification performance score. Those falling in the lower third were defined as LOW; those in the upper two thirds were defined as HIGH. PRIORS parameter in the Statistical Analysis Software (SAS) PROC DISCRIM was defined to reflect this definition.

Note 2: Tabled $F(1,1)$s are the ratio of the X^2 (ODD) /X^2 (EVEN). Generally the ratio of two independent chi-squares divided by their respective degrees of freedom (n_1, n_2) is defined as an F. See McNemar, Q. Psychological Statistics, John Wiley and Sons, Inc. 1962, pp. 250-251.

Note 3: It is noted that for some of the tabled findings, results based on a linear discriminant function analysis are provided. For these results statistical analysis performed by SAS determined that the within covariance matrices were homogeneous. In such cases no significant improvement in categorizing soldiers results from using individual within covariance matrices—as required for computing a quadratic discriminant function. Linear discriminant functions were computed using a pooled within covariance matrix.

Table 19

Discriminant Analyses Performed Using ASVAB Scaled Scores and Subtests (Test Forms 5-14) for a Calibration (ODD HALF), Test (EVEN HALF) and Total Sample

ODD HALF (CALIBRATION DATA)

ASVAB Scaled Scores (Test Forms 5-14) Classified by a Linear Discriminant Function as

APRIORI ACHIEVE GROUPS		HIGH	LOW	TOTAL
	HIGH	145 / 90.06	16 / 9.94	161 / 100.00
	LOW	33 / 40.74	48 / 59.26	81 / 100.00
	TOTAL	178 / 73.55	64 / 26.45	242 / 100.00

$X^2 = 67.39, \underline{p}<.001$ "Hits" = 80%

EVEN HALF (TEST DATA)

ASVAB Scaled Scores (Test Forms 5-14) Classified by a Linear Discriminant Function (Test Data) as

APRIORI ACHIEVE GROUPS		HIGH	LOW	TOTAL
	HIGH	126 / 78.26	35 / 21.74	161 / 100.00
	LOW	58 / 72.50	22 / 27.50	80 / 100.00
	TOTAL	184 / 76.35	57 / 23.65	241 / 100.00

$X^2 = .98, \underline{p}>.05$ $\underline{F}_{(1,1)} = 68.60, \underline{p}>.05$ "Hits" = 61%

TOTAL SAMPLE

ASVAB Scaled Scores (Test Forms 5-14) Classified by a Quadratic Discriminant Function as

APRIORI ACHIEVE GROUPS		HIGH	LOW	TOTAL
	HIGH	279 / 86.65	43 / 13.35	322 / 100.00
	LOW	88 / 54.66	73 / 45.34	161 / 100.00
	TOTAL	367 / 75.98	116 / 24.02	483 / 100.00

"Hits" = 73%

ASVAB Common Subtest (Test Forms 5-14) Classified by a Quadratic Discriminant Function as

APRIORI ACHIEVE GROUPS		HIGH	LOW	TOTAL
	HIGH	167 / 85.64	28 / 14.36	195 / 100.00
	LOW	50 / 51.55	47 / 48.45	97 / 100.00
	TOTAL	217 / 74.32	75 / 25.68	292 / 100.00

$X^2 = 39.45, \underline{p}<.001$ "Hits" = 73%

ASVAB Common Subtests (Test Forms 5-14) Classified by a Quadratic Discriminant Function (Test Data) as

APRIORI ACHIEVE GROUPS		HIGH	LOW	TOTAL
	HIGH	163 / 84.02	31 / 15.98	194 / 100.00
	LOW	70 / 72.16	27 / 27.84	97 / 100.00
	TOTAL	233 / 80.07	58 / 19.93	291 / 100.00

$X^2 = 5.70, \underline{p}<.02$ $\underline{F}_{(1,1)} = 6.93, \underline{p}>.05$ "Hits" = 65%

ASVAB Common Subtests (Test Forms 5-14) Classified by a Linear Discriminant Function as

APRIORI ACHIEVE GROUPS		HIGH	LOW	TOTAL
	HIGH	346 / 88.95	43 / 11.05	389 / 100.00
	LOW	140 / 72.16	54 / 27.84	194 / 100.00
	TOTAL	486 / 83.36	97 / 16.64	583 / 100.00

"Hits" = 68%

Note 1: ACHIEVE groups were defined based on rank order of soldiers identification performance score. Those falling in the lower third were defined as LOW; those in the upper two thirds were defined as HIGH. PRIORS parameter in the Statistical Analysis Software (SAS) PROC DISCRIM was defined to reflect this definition.

Note 2: Tabled $\underline{F}_{(1,1)}$s are the ratio of the X^2 (ODD) /X^2 (EVEN). Generally the ratio of two independent chi-squares divided by their respective degrees of freedom (n_1, n_2) is defined as an $\underline{F}$. See McNemar, Q. Psychological Statistics. John Wiley and Sons, Inc., 1962, pp. 250-251.

Note 3: It is noted that for some of the tabled findings, results based on a linear discriminant function analysis are provided. For these results statistical analysis performed by SAS determined that the within covariance matrices were homogeneous. In such cases no significant improvement in categorizing soldiers results from using individual within covariance matrices—as required for computing a quadratic discriminant function. Linear discriminant functions were computed using a pooled within covariance matrix.

Discussion

Individual Correlation Relationships

In the analyses reported here, the intent was to explore in several ways the relationship between the criterion variable (vehicle identification performance) and predictor variables (ASVAB Scaled and Subtest scores). Concern was focused not only upon the magnitude of the relationship but also upon the validity of findings reported. Within chance expectations, the obtained relationships were concluded as valid--whether ASVAB Scaled Score or Subtests were used with forms 5-7 or 8-14. For the correlations between criterion and individual predictors, values obtained indicated that, depending on which predictor is used, between 1% and 13% of the variability between criterion and predictors is in common. Obviously there is a great deal of criterion variability which must be accounted for by other factors. For ASVAB Scaled Scores, the range of obtained correlations is .212 (for CL Composite) to .336 (for GM Composite); for ASVAB Subtests this range is .156 (for SP Subtest) to .358 (for GI Subtest). Other research (Maier & Grafton, 1981, and Weltin and Popelka, 1983) using final course grades and the CL ASVAB Composite and related Subtests with homogeneous Army samples generally report substantially higher correlations (.50-.78) than those obtained in the present research. It is generally recognized that the greater the similarity of content between criterion and predictor measures, the larger the observed relationship will be. Even without detailed criteria analysis, it is not difficult to conclude that items in the final course exam for clerical training courses are probably more similar to ASVAB Subtest items which define the CL Composite than the processes which are involved in the complex visual perceptual discrimination task used in this research. It is well known that when the range of scores being used in computing a correlation is narrow, the magnitude of the correlation is attenuated. Attributing differences in the magnitude of the correlations presented here compared to other studies (utilizing specific MOS Army samples) as possibly due to a restricted range of scores on the predictor variables is not probable. Since other studies reported generally used soldiers in a single MOS, it is more likely that there would be a restriction of range of predictor scores for soldiers in those samples than in the heterogeneous set of MOSs which comprised the sample for the current work. Consistent with this judgement, it is further relevant to state the rather obvious fact that the utility of the ASVAB (as currently designed) as a predictor will vary for different criterion skills which define competency in different MOSs. The question asked should not be "Is the ASVAB a valid predictor of Army performance"? but rather, "For what Army performance is the ASVAB a valid predictor?" Beyond this point it is appropriate to conduct additional research aimed at identifying new ASVAB Composites which relate to other Army skills. Such research probably would naturally involve: 1) Trying different Subtest combinations; 2) developing Subtest item-criterion correlations as a basis for using specific items from different Subtests to develop new Composites; and 3) the development of new Subtests which include items which would appear to relate better--have greater "face validity"--to the criterion for which a predictor is desired.

Multiple Correlation Relationships

When the stepwise regression procedure was used as a basis for selecting "optimum" multiple correlation relationships as opposed to an a priori model, the most general finding was that adding ASVAB predictors into linear combinations generally does not result in significant improvements in relationship between criterion and predictors over use of individual predictors. When one examines the relatively high correlation between predictors (See Appendix A) and notes the relatively low correlations between individual ASVAB predictors and the criterion, this finding is not surprising. It is generally recognized in the test and evaluation community that these are the conditions which tend to make use of the multiple correlation approach less profitable.[15]

Beginning with an a priori model, Horne's (1986) work includes use of a multiple correlation approach (instrumental variable regression) to explore the relationship between written and hands-on tests used by Army training schools for different MOS samples for several systems and the predictors selected for the model. While the focus of the current research effort has not been on examining the role of demographic/background variables, in order to provide some basis for comparing the present results with Horne's, a similar type of analysis[16] was used with the data in the CVI Master Data Base. It is important to note that results of the analysis presented here using Horne's (1986) model speak only to the <u>comparability</u> of conclusions reached by Horne when another performance variable is used. There is no intent to imply that the conclusions reached from this analysis in the present research (or Horne's) are valid. A model's validity necessarily depends on the underlying assumptions on which the model is based. Embodied in those assumptions are the variables used, how the categories of those variables are defined and the mathematical relationships used to relate those variables. For example, it is not clear but that had Horne's model included more than binary categories for the education, training and race variables, the conclusions reached might well have been different--for his data as well as that used in the present work. Variables in the Horne model and for CVI data are shown below in Table 20. From review of this table it is noted that except for the performance and training variables, the variables used in developing the multiple regression relationships are identical. Use of a different performance (criterion) variable tests the generalizability of Horne's findings to a different set of competency skills. For the training variable it was reasoned that when a soldier is assigned to a duty MOS which is the same as his assigned MOS, he is developing his skills in that MOS. It is Army policy to test soldiers in their assigned MOS regardless, and not in their duty assignment. Significance tests for predictor coefficients of the Horne (1986) model with the vehicle identification performance criterion variable is shown in Table 21 below.

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[15]McNemar, Q. <u>Psychological Statistics</u> John Wiley and Sons, Inc. 1962, p. 187.
[16]Since time constraints precluded acquisition of the software used by Horne, the least squares estimator approach found in PROC RSQUARE of SAS was used.

Table 20

Criterion and Predictor Variables Used by Horne and Matched in Present Research

		Horne (1986)	Current Research
Criterion Variables	Performance	Training Data for 11 groups (4 systems)	Vehicle Identification Data
Predictor Variables	Trainability	AFQT scores	AFQT scores
	Education	High School diploma status	High School diploma status
	Experience	Rank	Rank
	Training	Received training in MOS tested in SQT	Similarity of duty and assigned MOS
	Race	White vs non-white	White vs non-white

Table 21

Significance Tests for Regression Coefficients Obtained in Current Research
Using Horne's (1986) Predictor Variables ($\underline{n}$ = 517)

Coefficient	B Value	Standard Error	$\underline{F}$	$\underline{P}$
Intercept	2.659			
AFQT (17/21)	.092	.016	34.72	.0001
Diploma Status (1/21)	.679	.918	<1	.460
Rank (13/21)	1.230	.292	17.77	.0001
MOS Training (0/16)	-1.621	1.069	2.30	.130
Race (5/21)	- .640	.790	<1	.418

R= .359

Note: Numbers in parentheses are the number of cases in Horne's (1986) analyses where the variable provided a significant contribution to prediction of the criterion variable.

Results presented in Table 21 for the CVI data are generally consistent with findings for Horne's (1986) analyses. Specifically, AFQT and rank are consistent performance predictors. Consistent with results of the present analysis and as was frequently found by Horne (1986), differences based on diploma status, MOS training and race were not significant performance predictors. It is interesting to note that the resultant multiple correlation

obtained (See Table 21) with entry of background/demographic variables results in no appreciable predictive improvement over that obtained by the best ASVAB Scaled Scores or Subtest alone.

Differential Weighting Correlations

As noted from review of Tables 15 and 16, there were increases in the absolute value of Pearson-type correlations when different predictor values receive their own weight. Since more of these differences were statistically significant than might be expected by chance, it is reasonable to conclude that in some cases differential weighting will be effective in demonstrating an increase in the relationship between performance and aptitude variables. Further research to document the efficacy of the differential weighting procedure is warranted.

In order to address the validity of the differentially weighted correlations, two procedures were used. First, differentially weighted correlations were obtained for random halves of the data for each ASVAB predictor. These correlations speak to the replicability of findings across independent samples. A second procedure involved using the weights estimated for each half to compute a correlation for the entire sample. As noted, for the Composites, no significant differences occurred; however, several were significantly different for ASVAB Subtests--more than might be expected by chance. It might be concluded that differentially weighted correlations are valid for Composites which are scaled scores but not Subtests which are percentages. It is not clear whether these conflicting findings can be attributed to differences in the type of variable used. Of the seven cases where differential weighting correlations for random halves do differ significantly, neither of the correlations for (or based on) random halves have a magnitude which is significantly greater than zero for five of these cases. It might be concluded that it is unreasonable to test for significant differences among two values which are in themselves not significant. For the remaining 35 comparisons, two show a significant difference. With alpha set at .05, approximately two such differences could be expected by chance.

Discriminant Analyses

Perhaps the most important finding of this research effort is the fact that soldiers can be assigned a priori to low and high vehicle identification achievement groups with about 75% accuracy using a quadratic discriminant function involving only ASVAB Scaled Scores. Were background and demographic variables also introduced into the discriminant analysis, additional achievement classification improvement might result. Again, the inclusion of demographic and background factors were generally beyond the scope of the present research effort. Discriminant functions might be best suited for use in guiding new soldiers into MOSs where combat vehicle identification is or is not an especially critical skill.

Conclusions

Correlations based on equally weighted scores for individual ASVAB Scaled Scores and Subtests are in the high .20s and low .30s.

When ASVAB scores for individual Scaled Scores and Subtests are differentially weighted, modest increases (of about .05) in the absolute value of the correlations may be obtained.

Multiple correlations involving more than one ASVAB Scaled Score or Subtest are comparable to correlations obtained by the differential weighting of scores for individual ASVAB Scaled Scores and Subtests.

Soldiers who will score "high" or "low" in vehicle identification performance can be identified in advance about 75% of the time by using quadratic discriminant functions involving ASVAB Scaled Scores.

Supplementary analyses involving use of random sample halves generally confirm the validity of relationships reported.

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Appendix A

ASVAB Intercorrelational Matrices

Table A-1

Correlational Matrix of ASVAB Scaled Scores for Test Forms 5-14

		AFQT	CO	FA	MM	GM	CL	GT	EL	SC	ST	OF
AFQT[a]		1.0000										
	P	.0000										
	N	726										
CO		.76998	1.0000									
	P	.0001	.0000									
	N	724	729									
FA		.81893	.80020	1.0000								
	P	.0001	.0001	.0000								
	N	724	726	729								
MM		.69254	.83422	.77207	1.0000							
	P	.0001	.0001	.0000	.0000							
	N	726	727	729	736							
GM		.80031	.81563	.80064	.89195	1.0000						
	P	.0001	.0001	.0001	.0001	.0000						
	N	725	726	729	733	733						
CL		.81902	.67641	.75205	.58595	.65144	1.0000					
	P	.0001	.0001	.0001	.0001	.0001	.0000					
	N	724	728	726	728	728	730					
GT		.84884	.57920	.73294	.52801	.67798	.65198	1.0000				
	P	.0001	.0001	.0001	.0001	.0001	.0001	.0000				
	N	611	613	613	618	616	613	772				
EL		.82939	.82613	.84176	.87035	.92353	.66194	.71342	1.0000			
	P	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0000			
	N	724	726	729	729	729	726	613	729			

Table A-1 (cont'd)

	AFQT	CO	FA	MM	GM	CL	GT	EL	SC	ST
SC	.89723	.81539	.79307	.77765	.84352	.84715	.66322	.79978	1.0000	
P	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0000	
N	725	727	728	731	730	728	614	728	731	
ST	.85291	.78093	.85739	.76686	.88019	.70190	.79006	.86051	.79098	1.0000
P	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0000
N	725	726	729	733	733	728	616	729	730	733
OF	.69983	.73303	.82336	.84063	.80775	.65234	.55258	.74432	.73148	.69677
P	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
N	720	729	729	734	733	730	619	729	731	733

[a]All values on the same line as the Scale Score names are correlations.

A-2

Table A-2

Correlational Matrix of ASVAB Subtest (Percent Correct) Scores for Test Forms 5-14

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI
GS[a]	1.0000									
P	0.0000									
N	739									
AR	0.559	1.0000								
P	0.0001	0.0000								
N	732	748								
WK	0.770	0.551	1.0000							
P	0.0001	0.0001	0.0000							
N	737	732	748							
PC	0.577	0.506	0.672	1.0000						
P	0.0001	0.0001	0.0001	0.0000						
N	354	352	354	362						
NO	0.374	0.394	0.402	0.144	1.0000					
P	0.0001	0.0001	0.0001	0.0066	0.0000					
N	736	730	738	354	748					
CS	0.273	0.151	0.307	0.259	0.656	1.0000				
P	0.0001	0.0044	0.0001	0.0001	0.0001	0.0000				
N	360	356	360	354	360	362				
AS	0.601	0.341	0.561	0.403	0.154	0.164	1.0000			
P	0.0001	0.0001	0.0001	0.0001	0.0033	0.0018	0.0000			
N	360	356	360	354	360	360	360			
MK	0.502	0.689	0.466	0.468	0.381	0.212	0.218	1.0000		
P	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000		
N	735	729	734	354	735	359	359	736		
MC	0.686	0.557	0.598	0.487	0.312	0.192	0.581	0.493	1.0000	
P	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0000	
N	736	730	734	354	735	360	360	735	748	
EI	0.662	0.476	0.610	0.458	0.280	0.191	0.650	0.451	0.636	1.0000
P	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0000
N	737	731	739	354	740	360	360	735	735	748

Table A-2 (cont'd)

	VE	GI	AD	SP	SI	AI	CM	CA	CE	CC
VE P N	0.763 0.0019 360	0.528 0.0001 356	0.953 0.0001 360	0.782 0.0001 354	0.337 0.0001 360	0.406 0.0001 360	0.587 0.0001 360	0.425 0.0001 359	0.555 0.0001 360	0.587 0.0001 360
GI P N	0.630 0.0001 376	0.499 0.0001 375	0.671 0.0001 376	—	0.338 0.0001 374	—	—	0.475 0.0001 373	0.546 0.0001 373	0.644 0.0001 375
AD P N	0.028 0.5884 375	0.087 0.0940 373	0.046 0.3777 377	—	0.361 0.0015 376	—	—	0.121 0.0196 373	0.030 0.5678 372	0.104 0.0426 377
SP P N	0.243 0.0001 375	0.313 0.0001 375	0.113 0.0279 377	—	0.155 0.0026 375	—	—	0.368 0.0001 373	0.450 0.0001 373	0.332 0.0001 376
SI P N	0.660 0.0001 379	0.491 0.0001 376	0.535 0.0001 380	—	0.288 0.0001 380	—	—	0.400 0.0001 377	0.630 0.0001 376	0.739 0.0001 381
AI P N	0.644 0.0001 379	0.474 0.0001 376	0.551 0.0001 380	—	0.280 0.0001 380	—	—	0.408 0.0001 377	0.655 0.0001 376	0.764 0.0001 381
CM P N	0.159 0.0019 379	0.107 0.0389 376	0.110 0.0318 380	—	0.093 0.0691 382	—	—	0.006 0.9077 377	0.125 0.0153 376	0.300 0.0001 381
CA P N	0.171 0.0008 379	0.109 0.0341 376	0.197 0.0001 380	—	0.162 0.0015 382	—	—	0.046 0.3696 377	-0.028 0.5882 376	0.188 0.0002 381
CE P N	0.116 0.0243 379	0.084 0.1022 376	0.063 0.2228 380	—	0.182 0.0003 382	—	—	0.037 0.4748 377	0.018 0.7226 376	0.156 0.0023 381
CC P N	0.295 0.0001 379	0.175 0.0007 376	0.244 0.0001 380	—	0.136 0.0079 382	—	—	0.117 0.0230 377	0.1653 0.0013 376	0.364 0.0001 381

Table A-2 (cont'd)

	GI	AD	SP	SI	AI	CM	CA	CE	CC
GI	1.0000								
P	.0000								
N	386								
AD	0.005	1.0000							
P	0.9176	0.0000							
N	373	386							
SP	0.208	0.081	1.0000						
P	.0001	0.1192	0.0000						
N	374	375	386						
SI	0.576	0.064	0.273	1.0000					
P	.0001	0.2147	0.0001	0.0000					
N	376	378	377	386					
AI	0.601	0.032	0.280	0.750	1.0000				
P	.0001	0.5379	0.0001	0.0001	0.0000				
N	376	378	377	384	386				
CM	0.098	0.026	0.072	0.361	0.339	1.0000			
P	.0574	0.6206	0.1627	0.0001	0.0001	0.0000			
N	376	378	377	384	384	386			
CA	0.109	0.039	-0.004	0.177	0.159	0.613	1.0000		
P	.0353	0.4476	0.9315	0.0005	0.0018	0.0001	0.0000		
N	376	378	377	384	384	386	386		
CE	-0.031	0.456	0.086	0.129	0.138	0.728	0.669	1.0000	
P	.5431	0.3775	0.0943	0.0113	0.0067	0.0001	0.0001	0.0000	
N	376	378	377	384	384	386	386	386	
CC	0.249	0.027	0.096	0.397	0.344	0.749	0.725	0.572	1.0000
P	.0001	0.6033	0.0635	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
N	376	378	377	384	384	386	386	386	386

[a]All values on the same line as the Subtest names are correlations.
Note 1: Correlations between Subtest VE (Test Forms 8-14) and Subtests appearing only in Test Forms 5-7 do not exist; the possibilities of a relationship are not shown in this Table. Other cases where Subtests do not appear in both sets of Test Forms are indicated by -.
Note 2: p values address the significance of individual correlations and were provided as part of the Statistical Analysis Software (SAS) PROC CORR output.

Appendix B

Assignment of Individuals to Low and High Vehicle Identification Achiever Classes

Predictions of Low vs High Vehicle Identification Achievers

As noted in the text, when an individual has completed his ASVAB test, a recruiter might find it useful to use these results as a basis for counseling a potential soldier into an MOS which does/does not require heavy emphasis on vehicle identification. Alternately a trainer may wish to use ASVAB scores as a basis for deciding who should receive repeated R&I training and who might best be assigned to perform some other unit function. The first thing a trainer must do is to determine whether the ASVAB scores available for a soldier were obtained with any of test forms 5-7 or 8-14. Since test forms 5-7 of the ASVAB are no longer used, a recruiter does not have this decision. In order to provide a basis for predicting apriori whether an individual is a high or low vehicle identification achiever, two discriminant function values must be computed--one assuming the ASVAB scores are for a LOW achiever and another assuming the ASVAB scores are for a HIGH achiever. These discriminant functions are computed "generalized square distances." The decision rule is to categorize the individual to the "achiever class" for the discriminant function which has the largest value.

For soldiers who have taken one of the ASVAB form 5-7 the discriminant functions to be computed follow:

ASVAB Test Form 5-7

Assumed LOW

$(.0400) (AFQT^2) + (.0179) (CO^2) + (.0943) (FA^2) + (.0327) (MM^2)$
$+(.0780) (GM^2) + (.0250) (CL^2) + (.0195) (GT^2) + (.0505) (EL^2) +$
$(.1330) (SC^2) + (.0688) (ST^2) + (.0280) (OF^2) + (.0016) (AFQT) (CO) +$
$(.0079) (AFQT) (FA) - (.0041) (AFQT) (MM) + (.0438) (AFQT) (GM) -$
$(.0062) (AFQT) (CL) - (.0116) (AFQT) (GT) - (.0030) (AFQT) (EL) -$
$(.1203) (AFQT) (SC) - (.0227) (AFQT) (ST) - (.0128) (AFQT) (OF) +$
$(.0059) (CO) (FA) - (.0182) (CO) (MM) + (.0089) (CO) (GM) -$
$(.0138) (CO) (CL) + (.0106) (CO) (GT) - (.0086) (CO) (EL) -$
$(.0182) (CO) (SC) - (.0043) (CO) (ST) + (.0047) (CO) (OF) -$
$(.0068) (FA) (MM) + (.0918) (FA) (GM) + (.0016) (FA) (CL) -$
$(.0006) (FA) (GT) - (.0617) (FA) (EL) - (.0472) (FA) (SC) -$
$(.1314) (FA) (ST) - (.0720) (FA) (OF) - (.0124) (MM) (GM) +$
$(.0205) (MM) (CL) - (.0018) (MM) (GT) - (.0413) (MM) (EL) +$
$(.0229) (MM) (SC) - (.0057) (MM) (ST) - (.0157) (MM) (OF) +$
$(.0250) (GM) (CL) - (.0104) (GM) (GT) - (.0467) (GM) (EL) -$
$(.1275) (GM) (SC) - (.1023) (GM) (ST) - (.0677) (GM) (OF) -$
$(.0170) (CL) (GT) - (.0073) (CL) (EL) - (.0095) (CL) (SC) -$
$(.0187) (CL) (ST) - (.0217) (CL) (OF) + (.0019) (GT) (EL) +$
$(.0020) (GT) (SC) - (.0046) (GT) (ST) + (.0032) (GT) (OF) -$
$(.0032) (EL) (SC) + (.0477) (EL) (ST) + (.0314) (EL) (OF) +$
$(.0660) (SC) (ST) + (.0444) (SC) (OF) + (.0677) (ST) (OF) +$
$(8.7478) (AFQT) - (.4097) (CO) + (2.8322) (FA) - (.5833) (MM) +$
$(6.3069) (GM) - (.4691) (CL) - (1.9422) (GT) - (1.0976) (EL) -$
$(13.3668) (SC) - (4.0498) (ST) - (2.3674) (OF) + 585.9960$

Assumed HIGH

$(.0525)$ $(AFQT^2)$ + $(.0126)$ (CO^2) + $(.1371)$ (FA^2) + $(.0424)$ (MM^2)
+$(.0798)$ (GM^2) + $(.0266)$ (CL^2) + $(.0154)$ (GT^2) + $(.0877)$ (EL^2) +
$(.1508)$ (SC^2) + $(.0921)$ (ST^2) + $(.0410)$ (OF^2) + $(.0159)$ $(AFQT)$ (CO) –
$(.0177)$ $(AFQT)$ (FA) – $(.0047)$ $(AFQT)$ (MM) + $(.0200)$ $(AFQT)$ (GM) –
$(.0262)$ $(AFQT)$ (CL) + $(.0067)$ $(AFQT)$ (GT) + $(.0211)$ $(AFQT)$ (EL) –
$(.1517)$ $(AFQT)$ (SC) – $(.0141)$ $(AFQT)$ (ST) + $(.0045)$ $(AFQT)$ (OF) –
$(.0073)$ (CO) (FA) – $(.0031)$ (CO) (MM) – $(.0016)$ (CO) (GM) –
$(.0047)$ (CO) (CL) + $(.0049)$ (CO) (GT) – $(.0013)$ (CO) (EL) –
$(.0308)$ (CO) (SC) – $(.0022)$ (CO) (ST) + $(.0037)$ (CO) (OF) +
$(.0598)$ (FA) (MM) + $(.1395)$ (FA) (GM) + $(.0360)$ (FA) (CL) –
$(.0069)$ (FA) (GT) – $(.1542)$ (FA) (EL) – $(.0316)$ (FA) (SC) –
$(.1894)$ (FA) (ST) – $(.1256)$ (FA) (OF) + $(.0138)$ (MM) (GM) +
$(.0246)$ (MM) (CL) – $(.0021)$ (MM) (GT) – $(.0829)$ (MM) (EL) +
$(.0015)$ (MM) (SC) – $(.0476)$ (MM) (ST) – $(.0494)$ (MM) (OF) +
$(.0237)$ (GM) (CL) + $(.0071)$ (GM) (GT) – $(.0947)$ (GM) (EL) –
$(.0906)$ (GM) (SC) – $(.1313)$ (GM) (ST) – $(.0775)$ (GM) (OF) –
$(.0124)$ (CL) (GT) – $(.0363)$ (CL) (EL) + $(.0110)$ (CL) (SC) –
$(.0298)$ (CL) (ST) – $(.0291)$ (CL) (OF) + $(.0052)$ (GT) (EL) –
$(.0218)$ (GT) (SC) – $(.0139)$ (GT) (ST) + $(.0022)$ (GT) (OF) –
$(.0106)$ (EL) (SC) + $(.1112)$ (EL) (ST) + $(.0815)$ (EL) (OF) +
$(.0657)$ (SC) (ST) + $(.0258)$ (SC) (OF) + $(.0975)$ (ST) (OF) +
(9.3018) $(AFQT)$ + $(.8890)$ (CO) + (1.1949) (FA) + $(.0204)$ (MM) +
(4.0008) (GM) – (2.2720) (CL) + $(.0919)$ (GT) – $(.0675)$ (EL) –
(13.9631) (SC) – (3.4030) (ST) – (1.1435) (OF) + 536.1770

For individuals who have completed one of the ASVAB 8-14 forms, the following discriminant functions should be used. Again, the individual is assigned to the "achiever class" for the discriminant function which has the largest value.

ASVAB Test Form 8-14

<div align="center">Assumed LOW</div>

$(.0761)$ $(AFQT^2)$ + $(.2030)$ (CO^2) + $(.1924)$ (FA^2) + $(.3418)$ (MM^2)
+$(.4027)$ (GM^2) + $(.2435)$ (CL^2) + $(.0335)$ (GT^2) + $(.6519)$ (EL^2) +
$(.5402)$ (SC^2) + $(.2276)$ (ST^2) + $(.7577)$ (OF^2) + $(.0279)$ (AFQT) (CO) +
$(.0312)$ (AFQT) (FA) + $(.1593)$ (AFQT) (MM) + $(.1597)$ (AFQT) (GM) −
$(.0441)$ (AFQT) (CL) − $(.0370)$ (AFQT) (GT) − $(.3303)$ (AFQT) (EL) −
$(.0210)$ (AFQT) (SC) + $(.1090)$ (AFQT) (ST) − $(.3176)$ (AFQT) (OF) −
$(.3114)$ (CO) (FA) − $(.0840)$ (CO) (MM) − $(.0376)$ (CO) (GM) +
$(.2206)$ (CO) (CL) − $(.0555)$ (CO) (GT) + $(.0700)$ (CO) (EL) −
$(.2901)$ (CO) (SC) + $(.0580)$ (CO) (ST) − $(.0291)$ (CO) (OF) +
$(.0503)$ (FA) (MM) + $(.2782)$ (FA) (GM) − $(.1339)$ (FA) (CL) +
$(.0498)$ (FA) (GT) − $(.3336)$ (FA) (EL) + $(.0937)$ (FA) (SC) −
$(.1043)$ (FA) (ST) − $(.0330)$ (FA) (OF) − $(.0642)$ (MM) (GM) −
$(.2036)$ (MM) (CL) + $(.0411)$ (MM) (GT) − $(.4623)$ (MM) (EL) +
$(.2807)$ (MM) (SC) + $(.4151)$ (MM) (ST) − $(.9092)$ (MM) (OF) +
$(.2534)$ (GM) (CL) + $(.0171)$ (GM) (GT) − $(.7794)$ (GM) (EL) −
$(.5383)$ (GM) (SC) − $(.1854)$ (GM) (ST) − $(.0355)$ (GM) (OF) +
$(.0050)$ (CL) (GT) − $(.0379)$ (CL) (EL) − $(.6691)$ (CL) (SC) −
$(.1783)$ (CL) (ST) + $(.3404)$ (CL) (OF) − $(.0431)$ (GT) (EL) +
$(.0035)$ (GT) (SC) − $(.0160)$ (GT) (ST) − $(.0042)$ (GT) (OF) +
$(.2684)$ (EL) (SC) − $(.2370)$ (EL) (ST) + $(.8263)$ (EL) (OF) +
$(.2867)$ (SC) (ST) − $(.4641)$ (SC) (OF) − $(.6761)$ (ST) (OF) +
(19.1408) (AFQT) + (3.9090) (CO) + (4.4964) (FA) + (17.4429) (MM) +
(21.0879) (GM) − (6.2952) (CL) − (4.8128) (GT) − (41.8742) (EL) −
(4.1360) (SC) + (13.1540) (ST) − (37.9618) (OF) + 1339.19

Assumed HIGH

$$(.0584)(AFQT^2) + (.2056)(CO^2) + (.2650)(FA^2) + (.5228)(MM^2)$$
$$+(1.2044)(GM^2) + (.6583)(CL^2) + (.0445)(GT^2) + (.8082)(EL^2) +$$
$$(1.7892)(SC^2) + (.4769)(ST^2) + (1.1882)(OF^2) + (.0596)(AFQT)(CO) +$$
$$(.0063)(AFQT)(FA) + (.0736)(AFQT)(MM) + (.1541)(AFQT)(GM) +$$
$$(.0091)(AFQT)(CL) - (.0302)(AFQT)(GT) - (.2397)(AFQT)(EL) -$$
$$(.0691)(AFQT)(SC) + (.0376)(AFQT)(ST) - (.2048)(AFQT)(OF) -$$
$$(.2858)(CO)(FA) - (.0805)(CO)(MM) + (.0984)(CO)(GM) +$$
$$(.2887)(CO)(CL) - (.0513)(CO)(GT) - (.0386)(CO)(EL) -$$
$$(.4031)(CO)(SC) + (.0167)(CO)(ST) - (.0395)(CO)(OF) -$$
$$(.2981)(FA)(MM) + (.7081)(FA)(GM) + (.1760)(FA)(CL) +$$
$$(.0779)(FA)(GT) - (.5406)(FA)(EL) - (.4527)(FA)(SC) -$$
$$(.4091)(FA)(ST) + (.4540)(FA)(OF) - (1.0390)(MM)(GM) -$$
$$(.7800)(MM)(CL) + (.0195)(MM)(GT) + (.2953)(MM)(EL) +$$
$$(1.3612)(MM)(SC) + (.8239)(MM)(ST) - (1.4440)(MM)(OF) +$$
$$(1.4261)(GM)(CL) + (.1246)(GM)(GT) - (1.6860)(GM)(EL) -$$
$$(2.5406)(GM)(SC) - (1.1826)(GM)(ST) + (1.3742)(GM)(OF) +$$
$$(.0629)(CL)(GT) - (.7581)(CL)(EL) - (2.1225)(CL)(SC) -$$
$$(.8662)(CL)(ST) + (1.2459)(CL)(OF) - (.1384)(GT)(EL) -$$
$$(.1018)(GT)(SC) - (.0618)(GT)(ST) + (.0292)(GT)(OF) +$$
$$(1.4312)(EL)(SC) + (.4901)(EL)(ST) - (.2213)(EL)(OF) +$$
$$(1.5206)(SC)(ST) - (2.1298)(SC)(OF) - (1.3286)(ST)(OF) +$$
$$(14.8507)(AFQT) + (5.336)(CO) + (3.7366)(FA) + (6.0965)(MM) +$$
$$(22.8707)(GM) - (.1554)(CL) - (3.7599)(GT) - (33.1835)(EL) -$$
$$(9.6594)(SC) + (3.1167)(ST) - (22.3377)(OF) + 1084.3100$$

In each case the category into which the model places the individual is for the equation yielding the highest value. In using these discriminant functions for categorization it probably will be desirable to have the equations programmed onto a floppy disk for use with a desk top computer. Input would involve simply entering the eleven ASVAB Scaled Scores, perhaps as directed by a menu.

Appendix C

List of Acronyms

Acronym	Definition
AA	Aptitude Area Composite (of ASVAB)
AD	Attention-to-Detail Subtest
AFQT	Armed Forces Qualification Test
AI	Automotive Information Subtest
AR	Arithmetic Reasoning Subtest
ARI	Army Research Institute
AS	Auto/Shop Information Subtest
ASVAB	Armed Services Vocational Aptitude Battery
CA	Classification Attentiveness Inventory Scale
CAC	Combined Arms Center
CC	Classification Outdoors Inventory Scale
CE	Classification Electronics Ineventory Scale
CL	Clerical Composite (of ASVAB)
CM	Classification Mechanical Inventory Scale
CO	Combat Composite (of ASVAB)
CONUS	Continental United States
CS	Coding Speed Subtest
CVI	Combat Vehicle Identification
EI	Electronics Information Subtest
EL	Electronics Composite (of ASVAB)
FA	Field Artillery Composite (of ASVAB)
GI	General Information Subtest
GM	General Maintenance Composite (of ASVAB)
GS	General Science Subtest
GT	General Technical Composite (of ASVAB)
HQ	Headquarters
MANPRINT	Manpower and Personnel Integration
MC	Mechanical Comprehension Subtest
MK	Mathematical Knowledge Subtest
MM	Motor Maintenance Composite (of ASVAB)
MOS	Military Occupational Specialty
MPRL	Manpower Personnel Research Laboratory
NO	Numerical Operations Subtest
OF	Operators/Foods Composite (of ASVAB)
PC	Paragraph Comprehension Subtest
R&I	Recognition and Identification
SAS	Statistical Analysis Software
SC	Surveillence/Communications Composite (of ASVAB)
SI	Shop Information Subtest
SOUTHCOM	U.S. Army South
SP	Space Perception Subtest
ST	Skilled Technical Composite (of ASVAB)
TAATS	Target Acquisition and Analysis Training System
USAEUR	U.S. Army in Europe
VE	Verbal Subtest
WK	Word Knowledge Subtest